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EXPLORATION IN THE ABAI BASIN, ABYSSINIA.*

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In the spring of 1898, when camped at Mendi, in lat. 9° 50′, on the road between Adis Ababa and the Beni Shangul in the East Sudan, I discovered that the sharp bend of the Abai from the west to the north had been placed on the maps far too high. Travellers had observed the point where it is joined by the Dabus, and had then apparently judged its course, by the visible profile of distant mountains, to have lain almost due east and west, and the cartographers had joined this line in a graceful sweep to the last point where the river had been observed at Asendabo, a district some 130 miles to the east (at the bend from south to west). By theodolite observation, I fixed the bend of the elbow, which is also at the junction with the Didesa, from a station at Gumbi where it was visible, to be about 25 miles south of the point assigned to it in the maps. The true course is not far, in fact, from the course assigned to a river marked as the Orghesa, which river may have been seen or heard of, but not recognized as the valley of the Nile. There is no such river, and it can therefore be expunged from the maps. I returned to England, having no time to make the necessary *détour*, owing to an intervening impassable country, and it was not till the spring of last year that I was able to return to the district. Taking Nejjo as a starting-point, I went by the Chochi range to the Abai valley to the point of the junction with the Didesa. In the mean time Mr. Crosby did good work along the Gojam side of the Abai, and, as far as could be done at the distance he was able to approach, gave the correct general course of the river. After spending the rainy season at Adis Ababa and the early winter in the Lake Suai district, I started

* Read at the Royal Geographical Society, December 4, 1905. Map, p. 656.

from the capital on January 4, 1905, to the north-west, to complete the survey of the Abai from the point of its westerly turn from south to west to the junction with the Didesa, *i.e.* roughly, from long. 37° 50′ to 35°.

Before starting to the Abai I made an expedition to Lake Suai, the northernmost of the chain of lakes that mark the rift-valley, or great depression, which starts from Lake Rudolf along the Hawash valley, to the south of the Great Plateau towards the Somali gulf. There are five islands in this Lake Suai, and the difficulty of getting to them under the conditions of a voyage of several hours in the dangerous cockle-shells of native rafts that only the amphibious inhabitants of the lake-shore could manipulate, lent some colour to the tradition that treasure and valuables had been deposited there during troublous times; the halo of romance had not been dissipated, and, in fact, had been rather enhanced by the mysterious hints of a certain journalist who had lately been there. As seems usual with the African lakes, the present sheet of water lies far below its original level. Two distinct terraces of former shores rise some 80 feet above the present level, forming a ring round that nearest to the lake on the north, about 4 miles from the shore, marking a former basin. A curious tradition, perhaps suggested by the apparent elevated shore, exists that at some far distant epoch what is now the lake was a kingdom 50 miles across, inhabited by seventy-eight chiefs, and that there was a tremendous cataclasm, accompanied by extraordinary noises; the territory with its population disappeared in a single night, and the lake and its islands made their appearance. The shores on the north side are fringed with a dense jungle of papyrus, out of the pithy stems of which the lake-dwellers, a tribe called Wattu, make their ingenious but very uncomfortable rafts. They are formed out of a single bunch bound in a solid round roll, and running to a fine point that is twisted up in the air and forms a high stem or cutwater; two other smaller bunches are tied to each side, forming a bulwark in the hollow of which the rower sits, and a certain amount of stability is obtained. They are fearfully crank, but quite unsinkable, as the pith stalks are as light and buoyant as corks.*

The voyage of two hours is not inviting when the wind blows strongly from the south. At this time of the year a strong wind springs up, blowing from this quarter up the lake, soon after sunrise, while swarms of hippos take their swims abroad in the night, and constantly charge upon the boats, so that the expedition has to be calculated to miss the encounter with hippos before sunrise and the wind before midday. Baron Erlanger's party, who had provided themselves with various patent inventions in the way of collapsible boats,

* The nearest approach to them are boats of Tasmania.

spent two whole days and nights drifting about at the mercy of the winds, floating water-logged and helpless, so that they were near finishing their expedition as soon as it had begun, in a catastrophe. Not having any other resources, I availed myself of the native boats, *tanquas* as they are called, and had a prosperous though somewhat nervous voyage to the principal island Adicha, where the so-called king of the islands lives.

There are five of these islands, called Adicha, Tulu Guddu, Fudoro, Debra Sina, and Galala; but Adicha is the most important as the

BOAT (TANQUA) USED ON LAKE SUAI.

royal seat and site of a very old church. On landing here a seedy-looking individual appeared at my tent-door. He wore a filthy shamma and a string of sheep's intestines wound round his head, a head-dress at once simple and effective. He led an equally seedy-looking sheep by a grass rope. Thinking this to be the usual durgo or present to a new-comer from his Majesty, I casually gave him a dollar, when I was informed, to my great embarrassment, that I had tipped the reigning sovereign. The story of the confirmation of his dignities, such as they are, was characteristic of the present Emperor Menelik. Some fifteen years ago, being in the neighbourhood to receive the submission of some rather turbulent Galla tribes in the neighbourhood, he questioned

the pretension of his Majesty of the islands to his title. The latter thereupon gave him his full pedigree, and satisfied the emperor of his claim to be fourteenth in descent from Ama Yasu, who was King of Abyssinia in 1682–1706.* The following are the names of his genealogical tree: Alibo (a name of a Galla village in Amorro) his father, Lipse Bartas, Waldo Maskal, Darkios, Bantu, Atto Kanafu, Gurgo, Ambasa, Wurka, Thoma, Enaro, Asko, Ama Yasu. He was reinstated in his position, and is now allowed an annual subsidy of food and clothes.

The boatmen and lake-shore dwellers are of the widely diffused tribe called Wattu, and are found round Lake Tsana and in Limmu and in the country north of Lake Rudolf. They are generally regarded by the Gallas and Amharas as an inferior, if not actually unclean race, owing to their being foul feeders, eating hippo, elephant, etc., a form of diet forbidden to the Amhara. Their language, of which I took a small vocabulary and examples, does not differ, beyond slight dialectic variations, from the eastern branch of Gallas and Guraghes.

The lake figures frequently in old chronicles, and especially in the wars of the Gran in the reign of Lebna Dengel, 1508–40, and Galawdewos (Claudius), 1540–50. There is an account of Abdel Kadar (in his history of the wars of Gran) that the Moslem leader camped on its shores, and wished to make boats to cross to the islands, given in this chronicle three in number, and having three churches each. Not even the enthusiasm of Islam was equal to the nervous strain of this sort of navigation. His followers stoutly refused, giving as a reason their want of provisions, and they finally persuaded the general to give up his boating expedition ('Futuh el Habesh,' p. 371: tran. R. Basset).

The islands were found to be useful places for banishment. Thus Baeda Maryam (1468–1478) punished an inconvenient prophet, Abba Mikael, head of the monks of Dabra Malago, for venturing to predict that the Amharic army would be defeated by the Moslems ('Perruchon Eskender,' pp. 31, 47). It was the scene, too, of a bloody battle between the Gallas under Robale, son of Mudana (who succeeded to Harmufa as luba, or priest-president of the Gallas confederacy), and Sartza Dengel, the Negus of Abyssinia (1563–1595). The king, according to a curious chronicle written by an Abyssinian monk of the time, "made a great slaughter and carried away much cattle," and the "Galla chief killed the Abyssinian general, Zara Johannis, and carried the war as far as Gojam after conquering Shoa." The same writer gives in his account some idea of this deadly secular struggle of Gallas and Christians, and the swaying north and south of the line of frontier with alternate

* He was buried in an island Mebraka of Tsana, his remains taken on a tanqua with great pomp ('Cronaca Abbrev.,' F. Beguinot, p. 86).

Nubia
Reino de Goiam
Reino de Gafates
Reino de Bizamo
Reino de Angote
Amhara
Reino de Fategar
Reino de Oge
Reino de Dancali
Reino de Adea
Rn.º Cambate
Alaba
Rn.º Ganz
Rn.º Xoa
Rn.º Alamale
Rn.º Damut
Rn.º Gurage
Rn.º Sugamo
Rn.º Doaro Galas
Rn.º Xoa de sesmo
Rn.º Xoa de bairo
Rn.º Angote
Rn.º Angote Zog
Rn.º Mugar
Rn.º Gafates
Rn.º Gafates Zog
Rn.º Bizamo
Rn.º Gafates Zog
Rn.º Gafates Zog
Rn.º Gafates Zog

victory and defeat. He says the struggle reminded him of the proverb, "To-day to thee, to-morrow to another; victory given to me now, now to another; but there is one God who rules over all." * It must be always borne in mind that the Gallas gradually encroached up till their frontier reached to a line drawn across the west of Gojam along the centre of Shoa, and that it is within the last eighty years that the capital Adis Ababa was reconquered from them by the present emperor's grandfather, and only twenty-five years since the tribes among which my journey north to the Abai was to pass were finally subdued.

At the beginning of the year, January 4, 1905, I left Adis Ababa, and, ascending the southern slope of the plateau, camped on its edge to the north-west of the capital. The altitude of this extreme rim of the great circular basalt plateau which forms the highlands, or dagga, as it is called in Amharic, is about 8900 feet on its southern lip, slightly higher on the eastern, the latter being about 10,000 feet in elevation. The whole plateau is tilted to the west on a gradient of about 11 feet per mile. The actual level of the Nile bend is about 3000 feet.

Kitar and Wambera, which represent the top of the original basalt flow at the extreme western point near the Abai valley and at the edge of the Sudan plain, rise to a level of a little over 7300. Besides this general tilt of the whole plateau, there is a central depression roughly circular, to which the land from the external periphery slopes, giving the general conformation of a saucer with the centre cracked out, in which line of separation the Nile or Abai flows, while the radial fissures extending to the edge of the 3000–4000 feet thick plateau of volcanic rocks are utilized by the rivers which join the circular course of the Abai. The whole map would present the general figure of the spokes of a wheel running into the hub. In the middle of this hub, or circle (the province of Gojam), there is a lofty range, the highest altitude attained being over 12,000 feet by the T. Raba on the Talba Weha range. Where, however, these cracks or fissures in the great lava-mass "vergate" against or unfavourably to the watershed, there appear great chasms of absolutely perpendicular sides that suddenly yawn under the traveller's feet to lowlying, often fertile worlds 4000 to 5000 feet below.

The present seat of the king, and the new capital Adis Ababa, lies on the southern and more protected slope just below the extreme rim of the great plateau, having been removed there not more than twenty years ago (Adis Ababa means the "new flower"), owing to the destructive thunderstorms and hurricanes that the more exposed position of Entotto, the former capital, was subjected to. The first day's journey to the north brings the traveller to the upper level some 8400 feet

* "Zenahu la Galla," edit. Schleicher, 'Geschicht. d. Galla.'

above the sea. The general conformation of the tableland may be likened to the appearance presented by a section of trunk of a tree after a period of drying and seasoning; the cracks begin at the centre, and in drying take a radial direction to the circumference. The roads, therefore, largely follow, when possible, the high, almost level stretches of the plateau cut out by the ravines; for the cultivation, as well as the healthy climate, is characteristic of the original elevated surface, and is consequently the habitation of the "top dog," the conquering Amharic race, and their subject or agricultural fellahin, the Galla; while the under dog, the Shankala, Gonga, Gafat, etc., are driven into the Quorra, as it is called—the hot, feverish lower levels of the fissure valleys—where they struggle against the dense vegetation, bamboos, jungles, and generally undesirable conditions allotted to those who come off second best in the struggle for life.

The two main roads from Adis Ababa to the nearest point on the Abai, at Asendabo, pass one a little to the north-west of Fallé, and skirted by the great Mugr river gorge, which I followed, and the other, starting more to the west along the Mecha range, strikes nearly due north and joins the other in the Kutai district; and finally, crossing the Gudr river, ascends to the Asendabo Merawi plain to the ford below Kao. The first road passes through very fertile land, and is well cultivated, so far as the sparse population are able to do so, the great plain of Meta Robi and Chaffé Robi being specially adapted for grazing, though I saw besides some splendid fields of barley. There are two very deep and difficult fissures to cross, that of the river Urga or the Gundabrit valley, and that of the Gudr. The first is the steepest descent I ever saw in this country, the last part of the river being a slope of 52° and was practically a zigzag of steps in the face of the rock, and only mules loaded with the greatest dexterity and watched with the greatest care could come down as mine did without a single accident.

Nothing could be more typical of the surprising effects of the scenery produced by these great open chasms, where the water-erosion has done little to smooth away contours or work out talus from the original wall-like scarp. Scrambling from the bottom of the crack, 4000 feet deep and not 200 yards across, the traveller lands on a shelf representing the talus of erosion, and about half a mile in width, and then by another stiff climb emerges on to exactly the original level, and sees stretching before him a gently undulating plain covered with splendid timber, numerous villages, and all the characteristics of a cooler climate. Nothing could be more beautiful than the vegetation on these high levels from the Gundabrit valley to the west. The ground is undulating, and at well-arranged intervals for effect the giant long-leaved yew tree, *Podocarpus elongatus* ("Arz" in Tigrine), rears a lofty deep green tower to the height of over 100 feet above

the banks of juniper and jasmine laced with festoons of clematis that form the undergrowth, alternating with stretches of grass strewn with flowers of all the colours of the rainbow.

Without exception, it is the most beautiful country I have ever seen. The rank, festering vegetation that clings to hot and debilitating climates may produce wonderful effects both in pictures and to the imagination, but is never so really charming as the fresh, open growth that accompanies the cooler, invigorating air of high altitudes of 8000 feet within the tropics. At each level the same flora characteristics of that altitude reappear without fail. At about 4000 to 5000 feet, the giant gardenia (*Gardenia gigantica*) covers whole mountain-sides for miles; lower down, slightly, though often mingled with them, forests of the Protea, with its great opal white blossoms; while in Horro and beyond the whole landscape seemed to be a combination of the dense masses of mauve, shading off into delicate white, of the vernonia and tamarind on a background of the deep green masses of the giant cordia. An erythrina appears here in a new species, and is very effective with its bunches of deep red blossoms, set almost horizontally on the very extremity of the almost bare branches. It produces the curious artificial effect of branches of flowers attached to the points of an enormous broom. It reaches 40 feet or more. The native name is Gorech. The *E. tomentosa* was found by Heuglin in Gojam, but is markedly different.

The overcrowding of the trees and production of "jungle" are largely prevented by the burning of grass during the dry season, a process which, by destroying saplings and young trees, gives survivors room to grow into giants, and spaces thus kept free form open glades exactly adapted to produce the effect of well-laid-out grounds. Alas! the old story, "Every prospect pleases, and man alone is vile," is forced upon us once more. Everywhere lay abandoned houses and settlements given up by the industrious Galla owing to extortion and oppression of their overlords. "There would be much fruit and more tillage in the country if the great men did not ill-treat the people, and take what they have, so the latter do not choose to provide more than they require and is absolutely necessary." This was written in 1520 by Alvarez, the Portuguese envoy, and I have not a word to add.

It being impossible to follow the Abai from Asendabo, I had to make a *détour*, doubling the gorge at the point where the Finjar (Galla for "cataract") plunges from the Horro plateau 3000 feet into the valley below. The latitude was 9° 31′ 56″; that of Kao 9° 49′ 50″, which lies about north-east of it. The Finjar takes its rise in a great swamp or reed-choked lake of Chomen. Here a great battle was fought twenty-five years ago by Takla Haymanot, Negus of Gojam, against the Loya Gallas under Doro, their chief and general, in which the latter were defeated and his army decimated, the

fugitives flying into the swamp, where they perished in hundreds. These Loya are not mentioned in the Chronicles, but are among the list of six tribes of Gudru Gallas descendants of the fourth son of Orma—Luku, Loya, Serba, Amilu, Mallole, Andarsa (R. Basset, Notes to Chronicle; October, November, December, 1881, *Journal Asiat.*; Massaja, 'Lectiones Grammat.,' pp. 250, 251). They were probably a Gudru Galla offshoot, Gudru being one of the great original Galla tribes derived from Gudru, the descendant of Sapira, the progenitor of the Boran tribe of Gallas. On the south of this swamp lies the great peak of Tulu Amara, and bounding it on the east lies the range of the Jimma mountains, Gembo being the name of the highest point. On the northern end, called Gulecha, rising to 9000 feet in height, is a large village and a custom house, the seat of the Shum. The lake is fed by several streams from the Jimma range, and Jarre, Kalecha, and others on the north. From this point the road leads pretty nearly due north towards the Abai. At Shirba fine timber of the Podocarpus makes its appearance again, and other flowering trees, as gardinia, dombeya, and *Buddlea polystachya*, standing out of a wealth of tall flowers, among which the heliotrope blossoms are conspicuous, and a vernonia, rising to such a height as to form great purple tunnels into which a caravan completely disappears.

From Jer Daga another slight *détour* has to be taken to come round again to the Abai at the Ford of Lokman, below Lokman market, at the head of a road from the south Lekemti; and about 4 miles east of the district of Dabis and 5 from Jer Daga, we cross a small river, the Angar, the divide between Horro and Amorro, and, passing the market of Deru, descend into the Lagamsa river valley, leaving Daga on the north, and reach the village of Lokman.

The next river valley to Lokman is that of the Gonga, the divide between Amorro and Jidda district. Gonga is the survival of the Gonga or Gonka race, whose vocabulary was collected by Dr. Beke (*J. Phil. Soc.*, April, 1845), a Shankala tribe, and probably allied, if not of the same race, as the better-known Shinash tribe, which gives its name in the lowlying quolla on each side of the Abai immediately on the west.* It must be borne in mind that these lowlying river-valleys and the partially level talus just above form the refuge of the original Shankala (*i.e.* slave) blacks, the conquering Gallas being on the higher and healthier grounds, thus again yielding the select sites to their rulers, the Abyssinians. Accordingly, the region here being

* The Gonga country, however, figured in Pero Paez maps as an important region, and probably the Sinach displaced the inhabitants as a representative of the race. There is a pretty full vocabulary given by Beke. The Gongas belong to the ground-race group, Kaffa being the other limb, separated by the intrusion of the Galla tribes. See also for the improved later map of P. Lobo, trans. Legrand, p. 222.

low, rocky, covered with jungle and bamboo, the names cease to be Galla, and are representative of the primitive ground races.

Turning north at Dukon Gorgis, we come on to a caravan route taking us to Wunchit, the edge of the plateau overlooking the Abai gorge and Sinacha, the name given to low levels on each side of the river, and the ford Melka Mabil. Sinacha, as it was pronounced to me (Dr. Beke, *ibid.*, says in Agawi it is Tzintzi), is Shinas and Shenash (Xenaxa, d'Abbadie, *ibid.*, pp. 61 and 181) of the Chronicles, and the Sinasse of d'Almeida, 'Histor. de Ethiopia o alta.,' fol. 279; Tellez, 'Hist. Geral de Ethiopia o alta.,' liv. iv. cap. iv. Beke, who came from the north as far as the Nile down the valley of the Jinjira river, describes the descent as "an excellent road, such as I have never met with in the Kolla (valley)," the descent being most gradual, winding gently down the sides of the mountains. He, however, wrongly conjectures that this was the main route in former days between the north and Enarya. It is mentioned in the 'Chron. Susenyos' (chap. 33. 226 and 39. 142), and its market Gusman or Guman, as on the road along the northern bank of the Abai east and west; but the road on the south side is difficult, and does not seem to offer such facilities as that at Lokman for passing to the south. F. Fernandez, in 1613, it is true, went this way, when passing from Gojam to Enarya (Narea). In Gojam the viceroy Cellaxos (*i.e.* Sala Kristos) at Ombrama (Wambarema in Dr. Beke's map, just north of Sinacha) gave the Portuguese "some Gallas, some Shats, whom he sent for to act as guides to Narea over a road which traversed regions peopled for the most part by these two nations. Going west, after two or three days' journey across lands belonging to the Gonkas, they arrived at Sinasse (Sinacha), the principal town inhabited by the said Gonkas, who refused them an escort, which on behalf of the king they demanded for the rest of their journey to the Nile (Abai). The Gonkas refused and threatened violence, and the Portuguese were obliged to apply to the king for soldiers. In three days, with this escort, they arrived at Mine, at the place where they cross the Nile almost facing the land of Egypt, and west of its source. They crossed on rafts, as the river was in flood (early as it was, only the latter end of April), and went due south, the route to Narea being about 50 leagues. They were harassed by bandit Shats and Kaffirs, and next day crossed a small river Angar; and on the same day, changing the direction of the road, entered into a dense forest, descending a long and precipitous path to the banks of a large river, the Maleg. Surrounded by threatening Kaffirs, they crossed and reached next day the country of Narea, after ascending a mountain, Gauca, inhabited by an Abyssinian chief and a considerable following" (d'Almeida, lib. vii. chap. xiii.). In the map of Pero Paez, made very soon after, and probably founded on these accounts, Mine is put, in accordance with the narrative, in the bend of the Abai about

the junction of the Didesa. Going west, therefore, from Sinacha, Mine would be probably a ford in the Handak forest; the small river Angar would be crossed, and the Maleg* would be the Didesa, though the road does not correspond to any of the present roads from the Abai to Lekempti. The Shat country does not appear in P. Paez's map, but in Lobo's map, as between Enarea and the Didesa corresponding to the region of Limmu. The Shats seem to be a branch of the Gongas (*ibid.*, 2, fol. 338; cf. Guidi, 'Canzimi Gé'ezamariña,' 2, v. 33; C. Rossini, 'Di un nuovo codice d. Cr. Etiop.,' p. 18), who, according to d'Almeida, "lived in the most southern portions of Gojam, having come from their own land which was round about the Nile, and are great labourers and graziers" ('Chron. Abb.,' p. 39. Sartza Dengel died there, after eating fish at the river Gibbe).

The names of these provinces—Jidda, Chelia, and Evantu—are all represented by Galla eponyms in the earliest Genealogies of the Boran or second great division of Galla race, the first being the Baraytuma. Jidda figures as the son of Macha, the son of Dacha, the son of Sapira, the progenitor of the Boran Gallas. Of Jidda was born Hakako, whose firstborn was Gudru, and second Liban (south of Gudru on the maps). Of Daale, the brother of Jidda was born as third son, Obo—the Chelia Obo being probably a branch of this family, and frequently appearing in the wars of Susenyos (MSS., *ibid.* and Bòttego). Obo and Liban also appear as names of sons of Karayu, of the Baraytuma, but these seem, from their connection with Wollo, another of the sons given to Karayu, to belong to the eastern side of the Abyssinian plateau. The Wolio Gallas are now the most important of the Galla Muhammedan population.

Horro and Amorro do not appear in the early genealogy of the Zenahu Galla, but are given by Messaja ('Lect. Grammatical,' pp. 249–251) as two of the seven sons of Orma (their first reputed ancestor)—Borena, Tuloma, Liban, Gudru, Jimma, Nonno Horro, Amorro. Jimma lies to the south of Chomen, and Nonno further to the west and south of Gudru.

After crossing the Evantu mountain range, we again met the Abai on its southward sweep, and, following its direction, struck the Welmel tributary which divides Evantu from the Limmu range and district. The Welmel is the next most important affluent of the Abai since the Gudr, and drains the watershed north of Lekempti, and the water-parting on the west of which is the Didesa valley. At the point of crossing in lat. 10° 1′ the stream is 70 feet wide and 3 feet deep, running through a steep-sided channel at about $2\frac{1}{3}$ miles an hour. The

* D'Abbadie's servant had not heard of Maleg. I am inclined to think that Fernandez mistook the name "Melka," the Amharic word for "ford," for the name of the river.

name is duplicated in the south as a branch of the river in Arussi Gallaland (Bòttego).

Tulu Weni is the highest point of the Limmu range, and is a conspicuous landmark visible from both Lekempti and Gulecha mentioned above, the northerly point of the Jimma range; it served as a most valuable point in the triangulation.

The descent from Adisa, the spur of the Limmu range, into the Handak forest is very steep, and the first camp was a drop from 7160 to 4050 feet, and from high, bracing, cool atmosphere to the thick jungle smothered in grass 10 to 12 feet high, a dense pall of smoke brooding over the sweltering valley, caused by the great tracts of burning grass and undergrowth. The vegetation, as usual, changes completely with the altitude. The principal tree was protea and some gardenias, but the blossoms of the former had shrivelled up in the fires, though they were in full array of their splendid bright green leaves, which come out just *before* the rains. The whole of this Didesa valley, like that of the Dabus, is scooped out to the gneiss and schistose formations below the basalt, and covered over a large portion with broken quartz. After three stifling days' march with very unwholesome water in rock clefts in the river Lugo's partially dried-up bed, we arrived on the fourth morning at the Melka Gombalé, an easy ford over the Nile about 13 miles east of its junction with the Didesa. The level of the bed is 2310 feet.

On crossing the Abai, we found ourselves abandoned by our guide and in a howling wilderness. A pioneer party sent ahead could make no guess at a possible road, and so I resigned myself to a passing native. From all appearance this seemed a very poor chance indeed in such an absolutely lonely region, but by good luck a Galla with a donkey and a pack of dry goods happened to be crossing to the Shum's house on Sarebanti, the lofty peak for which we had been steering far from the other side of the Handak. After making an extortionate bargain, we were steered up a rocky bed of a dried-up stream, over huge slippery boulders and deep holes, an appalling scramble on to a steep ridge, after which only the gradients made the road difficult. The short struggle was expensive; my horse sprained his shoulder badly though running loose, and a mule slipped off the side of a precipice and fell at least 40 feet, luckily into a dense jungle of shrubs that broke the fall and saved his bones.

The Abai, at this point striking away from the shoulder of the Limmu range at a spur called Endibo, is arrested in its further progress south, and, making a few bends round the base of Tulu Sarebanti across the Handak forest depression, receives the waters of the Didesa, and then turns about north to lat. 11°, in Sudan territory. The Didesa is the most important river that flows into the Abai except the combined Adabai and Wunchit, which join it in lat. 10° 2′, before the great

river turns to the west. The discharge is one of enormous fluctuations. When I was there in April, 1904, at the point of the junction there was only one of the two channels in which water was flowing, and this measured about 110 yards across, and was not more than 3 feet deep. The other channel, separated by an island, was 125 yards across and perfectly dry, while the height of the flood measured by the high-water indications on the bank, would have represented a depth of over 5 feet in the middle section of this channel. This gives an idea of the futility of measurements. It is like trying to calculate the discharge at a tap without knowing when or how long the tap is turned on.

VIEW OVER THE ABAI AT THE JUNCTION WITH THE DIDESA.

The name Didesa appears to be modern. I see no mention of it in any old accounts before 1861, when d'Abbadie was travelling in Western Shoa and made inquiries. Both he and his fellow-travellers, Massya and others, seemed to have made an extraordinary error as to the distance of the Blue Nile, and were ready to believe that the Didesa was really that river; d'Abbadie generally shows an inclination to doubt the very few reliable native reports, and accept those that were most wildly inaccurate.

The Handak forest has always been famous as a favourite haunt for elephants. They seem to come up towards the

Nile by both the Didesa and Dabus rivers, attracted, no doubt, in the latter river-bed by the rich growth of young bamboo. North of the junction of the Didesa are the Naga Shankalas, the Handak or south side being only visited by hunters from the north for buffalo and antelope, hartebeast, and tetel. The Naga, d'Abbadie was informed, were not killed by the Gallas, as they paid tribute.

It is curious that this Naga tribe, hunters of elephant, and eaters of elephant flesh should bear the name of the old Ethiopic or Geez name for elephant, Nage. The modern Abyssinian name is Zehon, Tigre, Zehul; Somali Dogon. The kindred languages Afar and Saho have Dakano. On the north, in Bilin it is Jana; in Ghamir, Jan; in the south, in Kaffa, it is Dangiyo, Gonga, Dangaso; Wolamo and Warata, Dangarsa; Falasha, Jani. Only two languages in this group have an entirely different word—the Agau, Harmaj, and the Galla, Arba. We have in this word Jan a suggested explanation of the title given to the emperor, in ordinary usage, meaning "his Majesty," Jan Hoy. It is given by a passage in the chronicle of Mahdara Maryam. The King Sarza Dengel was engaged in a military expedition camped in Dambya, and was surprised to hear the inhabitants shout "Jan Hoy," which means "Hi! elephant," at an elephant which was destroying a field of corn, and fled when accosted with these objurgations. Then the king said that whenever he went to pillage corn, if the people cried "Jan Hoy!" he would consider their claims and redress their wrongs. From this arose the custom of addressing the king as Jan Hoy, as an equivalent for asking for justice, the expression gradually losing its special significance and becoming the ordinary term of address when speaking of his Majesty (Esteves Pereira, 'O Elephante em Ethiopia,' p. 7). The earliest notice appears on an hieroglyphic inscription on the Stele of Pithom in the year 264 B.C., where it is mentioned, after founding a colony of Ptolemais Pheron at the end of the land of the Negroes, "the Egyptian admiral hunted many elephants."

In the inscription of Adulis, Ptolemy Euergetes (246–221 B.C.) declares he made war in Asia with a great army of soldiers, ships, and Ethiopic elephants. The 'Periplus, Maris Erythraei,' written about 67 A.D., mentions elephant-hunting in the neighbourhood of the Nile, and says the ivory was brought to Axum, and then to the port of Adulis. In the Geez inscriptions of Axum, which go back to the sixth century, mention is made of an elephant corps called Sarve Dakan, which, I think, shows that these elephants were Indian, and accounts for the Indian name in ancient Ethiopic.* The ivory trade seems to have been flourishing in the days of Cosmas Indicopleustes, who

* Cf. Tigrine, *aha* = Sanscrit *ahi* ("cow"); *vide* Halevy, 'Rev. Semit.,' 1896, p. 64.

wrote about 545 A.D. He says "the Ethiopians do not know how to domesticate their elephants, and if it happens that a king desires one for spectacular purposes, they catch small ones and train them. They export the tusks to Persia, Homeritida, and to the Roman Empire." In the present day the killing of an elephant is celebrated by festive dances and a traditional chant for the Goro Gadai, or the killer of the monster. The Gallas, in honour of the performance, shave their

ELEPHANT HUNTER ("GORO GADAI"), WITH THE TAIL AS A TROPHY.

heads, leaving a high tuft of hair in the middle,* just as they do after slaying an enemy, and after certain ceremonial rites (*vide* 'Zenahu la Galla Schleicher,' p. 27). The Abyssinians decorate themselves with a small earring. The hero is permitted to blow his own trumpet in a "war boast," called the "Fakar," an ancient, time-honoured custom (in

* This custom runs through most of South Arabia and Hebrew races in ancient days. Warriors cut their hair and offer hair up at shrines of gods (*vide* Robertson Smith, 'Religion of Semites;' Wellhausen, 'Heidenthum,' p. 161).

default of newspapers), both for servants, soldiers, and commanders at periods of festivities or military parade, for the purpose of calling attention to their deserts.

The Shankalas are mostly eaters of elephant, as well as hunters. For tracking they use a small sort of whippet with a fox-terrier shaped head—very clever and quick dogs. They are pourtrayed with perfect accuracy in the monuments of Thothmes at Thebes (*vide* 'Denkm,' iii. 31, *a*. 11; xii. 26).

At the junction of the Didesa the serious work of goldwashing begins, and continues along the Nile and down the course of the Dabus and its tributaries. The deep erosion of the upper strata of basalt and trap, and subsequent decomposition, lays bare the gneissic and hornblendic schist formations below, so that nearly the whole country from the foot of Chochi to the river, a distance of 15 miles, is covered with quartz pebbles and boulders, and shows numerous outcrops. The decomposed portions of the reefs are strewn over the ground, and the gold they contain is thus washed into the small streams, and then carried into the Abai. Gangs of Gallas from around Nejjo come in shifts, and I have met over a hundred at a time going down or coming up, laden with their simple paraphernalia: an oblong shallow dish, a sharpened stake, a flat curved scoop like a hockey-stick, a small gourd with a string to fasten over their head and hang behind their ears, for carrying the gold nuggets, and, lastly, a huge pipe called a "gaia" held like a Persian Kalian, made out of a gourd. Nejjo is the principal market, and the gold-quarter presents a lively and curious aspect. The stock-in-trade is a small neatly worked basket, containing pebbles ground to equal the weights required for weighing out the gold, a small copper balance, and finally, the gold-dust in quills The amount of gold exported from Nejjo has been put by engineers living there at about £80,000 a year, and the tribute of the king is about one-half of this. It is hard to apportion the amount to different localities, but, judging by report and the number of men employed, by far the largest quantity, probably about three-quarters, comes from the Dabus and the Beni Shangul rivers, the Tumat and its tributaries, while the district of the Nile-Didesa junction brings a certain quantity, as well as the immediate neighbourhood of Nejjo.

The Dabus, with its affluents, is worked by gold-washers for something like 40 miles of its course; but last season the greatest number of men—it was calculated over 2000—were employed in the wider and slower-flowing reaches of the last 20 miles of its course to the Abai.

The history of this gold industry is not difficult to trace back to early days and some antiquity may be claimed for these workers' ancestors, seeing that alluvial gold is always easy to get, and could not have escaped the notice of natives in earliest times. The rings that are

made at Nejjo and the Beni Shangul are exactly those of the monuments of Osatirsen and Thothmes. Cosmas Indicopleustes describes how the king of the Axumites every other year through the Governor of Agau sends thither special agents to bargain for the gold. He then goes on to describe the same system of bargaining as that described by Herodotus. Not understanding the native language, they offered meat and various articles by leaving them on the ground and then retiring. In exchange for these the natives brought gold in nuggets like peas ($\theta\epsilon\rho\mu\alpha$ = lupines). After various attempts to adjust the price by adding or taking away the various articles till both parties were satisfied, the bargain was struck. He adds, "the sources of the

GALLA GOLDWASHERS ON THE DABUS.

Nile lie somewhere in these parts, and rain falls in torrents, and there are many snakes, and a multitude of rivers that all flow into the Nile." While describing the inscription at Axum, he makes the following Scolion on a region Sasu (Kasu, according to Dillmann): "The land of Sasu, where there is much gold that is known as Tancharas in the remotest parts of Ethiopia." This may be the tsogaira,* or gold rings, the name for a ring for the arm among the Shankala gold-washers at

* Dillmann (*K. Akad. z. Wissen.*, 1897) gives *adanguol* (Bilin) and *adangura* (Tigrine), meaning "a bone." But although they collect the dust in quills, they probably always melted the gold into rings for long transport. There is a Gujerat and Sanscrit word, *tankara* = quarrier, or miner, which may afford the true explanation.

the present day. The Arab geographers are, as usual, very precise, but very confused. El Edrisi says, that on the Blue Nile there is a small town, Najagha; then it is six days to Marcata, and there is Jubaita (eight days further) in a desert, and here the people drink water from wells, and are given up to gold and silver mining. The mines are in Mount of Muris, four days from Jubaita. From the latter to Zeila is fourteen days. He says "the exports from the east coast of Somaliland were slaves and silver, and as to gold it is rare."

Another writer, Ibn Haukal, seems to have the mines now being developed in the direction of Suakin in his mind. Speaking of the Bajeh, situated between Habesh and Nubia, "where the inhabitants are blacker than Abyssinians, and where they have neither cities nor villages nor cultivated ground, there are gold-mines which extend from near the borders of Egypt to a certain castle on the east coast, which they call Assat (or Assab). Among these mines is a place called Allamy, situated on level ground. There are not in any quarter of the world such gold-mines as these." * As a specimen of geographical vagueness, I will give the following from El Hamadhani, who compiled a sort of Arabic Baedeker of the towns and countries of the Arab empire. He says, "Behind the country of Alwa (Aloa) there is a nation of blacks called Takina. They go naked, like the Zang (slaves). In this country gold grows or sprouts, and in their country the Nile forks, and they assert its rising is there, and behind the rising (the source of the Nile) there is darkness, and behind the darkness there is water in which gold grows, in the land of Takina and Ghana."

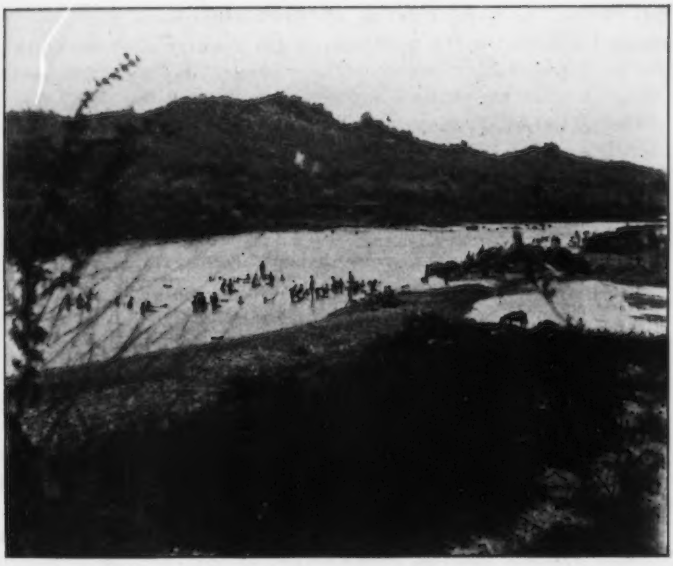
The Portuguese travellers, however, who first penetrated to the court of the Negus frequently mention the great amount of gold that was paid in tribute, especially from the country of Enarya. The Chronicles of the reign of Susenyos, for instance, are often concerned with expeditions to Wambera in the west towards the Fasay, and to Enarya in the south, to collect their gold tribute.

The Patriarch Bermudez, who said he travelled to the west along the Nile (about 1545), gives an amusing mixture of fact and fable in his description. He speaks of a country west of Damot, called Conche, which may be where a chief lived called Ash Gugce (perhaps Dejas, Guksa), Lord of Wealth. He took them across the large river (Didesa, apparently), and rightly describes the system of inflating leather sacks and skins, which they put under their necks to swim across. On the other side, where the land is barren and red (there are wide tracts of very

* Assab is the Aidhab of Ibn Batuta, and Allamy is the Allaké of Makrizi, between Abu Hammed and Suakin. Diodorus, quoting Agatharchides, gives an interesting account of the manner of working these mines, and full particulars of the system of boring and crushing ('Hist.,' vol. 3, c. 12, etc.; *vide* Wilkinson, *J.R.G.S.*, vol. 2, p. 47), by using children like chimney-sweeps to crawl into the shafts and pull out the quartz fragments.

deeply iron-impregnated soil), he says, "The soil contains two parts of gold to one of earth; this is what is obtained by melting, for which there are many artificers in the country, as many as there are blacksmiths here, and more, for gold is more common there than iron is here."

King Claudius, to verify the facts better, sent some of his men across. They went over and brought some of the earth, such as the others had brought, which, when melted down, yielded as much as the other. He also showed them across another river, a mountain which shone in places like the sun, evidently one of these great outcrops



GALLAS GOLDWASHING IN THE DABUS.

of quartz that are so frequent along the river-channels. The chief told the king that it was all gold, whereupon he was so delighted that he determined to make him a Christian. His reliability is somewhat discounted by the patriarch interlarding his account with equally solemn relations of griffins, "which are birds so large that they kill buffaloes and raise them in their claws as an eagle lifts a rabbit." "It is said," he goes on, "in certain precipitous and uninhabited mountains is born and lives the bird Phœnix, which is sole and alone in the world, and is one of the marvels of nature." Certainly if he ever saw a party of black giant hornbills stalking about and prodding in the soil, he might be forgiven for having his ignorance worked upon enough to

believe them "capable du tout." A grain, however, of unconscious information occasionally appears in the mass of ignorance, as when, for instance, he describes the gold that comes from the interior as having "points and shapes like some that comes from the Antilles" ("que o do serta tem pontas on area com o algum que vem das Antilhas"), which seems to indicate the pointed and spiculed nuggets that are found decomposed out of the pyrites and washed out into the small streams, specimens of which I have myself obtained in the Nejjo market.* A more reliable authority, Castañhoso, one of the dauntless body of 450 Portuguese who went under Gristoão da Gama to the assistance of King Claudius against the famous Grañ, or the left-handed, in 1541, tells us of the inducements the king held out to these Portuguese to remain in the country after the death and defeat of the Moslem enemy. The "preste," he says, "ordered the collection of all the chalices and crosses, and of all the silver from the churches, and of all the ornaments and bracelets of his mother, sister and relatives, and gave them to them, regretting much that he could give no more. He begged them not to go, for there was much gold in the country which he would give them; for far inland there were bestial Caffirs, who came in gangs on foot with much gold in bags at their sides to a fair in the back of his kingdom, which marches with these Caffres, which country is called Damot; that these negroes gave the gold in exchange for inferior and coarse Indian clothes and beads of red, blue, and green earth, which they valued highly, and gold very little; that if they would accompany him to that country they would conquer the mines, where they could glut themselves with gold." Bermudez makes out that he accompanied the king on this expedition, but the other Portuguese, to their honour, would not be tempted, saying that "they did not come to that country for any profit, only to serve God and the King our Lord."

The principal Galla tribe engaged in the gold industry are those of the Komo, a branch of the Gosa tribe dwelling at Nejjo and the surrounding districts. This Gosa Komo tribe extends to the Didesa river. Another branch of the Gosa are the Gosa Mao in Gojam, and Gosa Layo in the south and west of Nejjo, and Gosa Chemessi towards the Dabus. The name does not occur among the Chronicles, but they are probably a branch of the great Limmu group (D'Abbalie is informed (p. 174, *ibid.*) of the Komo and Mao tribes round Gulisa, a little south-west of Nejjo, but wrongly described as negroes), and extended north as the original Shankalas were dispossessed and dispersed. A type appears frequently among them closely approaching that described by the Portuguese of Enarea (P. D'Almeida, 'Hist. do Ethiop. o alta.,' chap. xiv.) as having

* Rusegger ('Reisen,' p. 311) describes the grains of gold in Tira, west of the White Nile. The character of the gold grains in the more watered regions of East Sudan showed naturally a more rounded and leafy water-worn character.

fine lips and straight noses, without any characteristics of negroes. They probably spread north, attracted by the gold industry. Their old system of government, by the election of a priest-king, called a Luba (formerly elected from each of the great septs or clans in rotation), seems to have gradually broken down before the steady pressure of the Abyssinian rule, and their ruler is now a Galla chief of the tribe, and received an Abyssinian official title of "Dejasmach." Not only this, but their primitive paganism is giving way to Abyssinian Christianity. The present chief, who began life as "Gumsa," was baptized with most of his followers and soldiers, and blossomed out into a

GALLA WOMEN (GOLDWASHERS).

Dejasmach Gabr Egsiabeher, or "servant of God," and the rest took Christian names of similar import. They still maintain, however, their system of an eight-year epoch or division of time, and the ceremonies of the butta (or eight-year period) still continue, though the power of the Luba within Abyssinian jurisdiction has been merged into that of officials appointed by the king. This Luba was described by Krapf ('Travels,' p. 76) thus: "He lets his hair float wildly, carries a bell in his hand, and a copper frontlet encircles his brow. 'Luva, cujus imperio Phylarchi parent sed nonnisi in bello. Primum ejus facinus est cogere plebem et Habessiniam irrumpere' (Ludolf, lib. i. c. 16).* He might, in fact, be regarded as a sort of

* Luba (or, as Ludof spells it through a native pronunciation, Luva) may be identified with the Hebrew Levi, לֵוִי (لوان. lewān, of the South Arabian inscriptions) (Euting, 37, 49, and 55).

elected mad Mullah for declaring war and inciting to raid, and the curtailment of his power has not been any loss to the cause of peace and good government.

The following is an account of the election of a Luba as witnessed by one of the Italian engineers at Nejjo, Mr. Paradisi. The day is fixed as lucky according to divination by the Mora Ilalcha, or Haruspex, generally towards the end of September or October 1. Those who participate in the election, and chief performers, have to number five "butta," *i.e.* forty years of age, and at the time appointed meet by the river Alaltu (a name for rivers of frequent occurrence in Galla country). Each kills a bullock as a sacrificial victim in honour of their god Waq, and carries a piece of the hide on his head to the place of meeting, and all smear themselves with the blood, as well as a plentiful unction of butter. Traditional chants are sung, and the day ends in general orgy. The third year of the period the elected takes the name of Luboma, and all those who participated are circumcised. At the end of the term of eight years they again meet at the Alaltu river, and a man is elected, who, taking the name of Abba Gaffaddu (or the interrogator), puts him under an examination as to whether a father or mother or any of his family have died, if he has quarrelled or ill treated any of his neighbours, if he has been industrious, even if any animal of his has been ill or died of disease, and, finally, if any one has had to complain of his behaviour. The Luba elect then is presented with a spear and kills a bullock, and each person anoints his head with the blood, and a rush takes place to seize a piece of the hide, and every one who has got one distributes the bits to his friends and relations for luck. This hide ceremony reminds one of the part played by the skin of a victim in Arabia, Greece, and Rome. The skin of a victim was sacred, according to Herodotus, to the Libyans. A girdle of the skin was made into amulets for Arab children, and magical thongs were cut from the skin of the Piaculum by the Luperci at the Lupercalia games in ancient Rome (cp. dressing in hides, etc., at feast of Dionysos: Boissonade, 'Anec. Greca,' vol. 5). The smearing with blood is also universal among Semites—both as making the god participant and constituting blood brotherhood (*vide* R. Smith, *ibid.*, p. 321; Wellhausen, 'Heid.,' p. 125).

The higher lands round Mendi are the furthest extension in this direction of the Galla. We now descend into a hotter and lower country inhabited by the Shankalla or East Sudan races. The Berta used to be the principal tribe in these parts, but the Dervishes so completely wiped them out that the answer of the Arab guide to the question as to their whereabouts is the simple *ma fish* ("they don't exist"). The Beni Shongul who represent the Muhammedan vassals of a semi-Arab reigning family inhabit the hot unhealthy country between the Dabus and Famaka. Their principal defence, in fact,

against the blessings of Abyssinian rule lies in this—that no Abyssinian, if he can help it, will go into their country. My own muleteers, who were undefeated in endurance and toughness, all abandoned me at this point, and refused to move for any wages I could offer. They have a proverb, "The cut on a man's body is like a cut on the trunk of a tree," and in cases of cuts and wounds they are extraordinarily plucky, as well as healthy, as I can testify from my own experience of a man surviving my amateur surgery—sewing up a man's stomach from which his vitals were protruding, the result of a gash with a kitchen knife; but fever has an unholy terror for them, and they seem to offer very little resistance to an attack.

Before the paper, the PRESIDENT said: Just six years ago, Mr. Weld Blundell read a paper here, which some of you may remember, dealing with his travels during the previous eighteen months or two years in that country of Abyssinia, which must long remain one of the most interesting countries in the world. In that paper he described his journey from the Gulf of Aden to the valley of the Nile, and I dare say you will remember that he added largely to our geographical information (especially to our hydrographical information) about that region. He was accompanied on that journey by Dr. Koetlitz, who afterwards went as geologist with the Antarctic Expedition with Captain Scott, and who contributed a very excellent appendix, which also added largely to our knowledge. Since then Mr. Blundell has again been travelling in Abyssinia, and the geographical results of this journey we are going to hear to-night. You will understand that Mr. Blundell's travels have not been confined to Abyssinia; he has been a wanderer for many years. He has one defect—he is not one of those who publishes all he knows, but I hope later on he will give us more information than he has at present vouchsafed to us. I call upon him to read his paper.

After the paper, Sir THOMAS HOLDICH said: It is thirty-seven years since I made acquaintance with Abyssinia, and then the point of my acquaintance was very far removed from the scene of Mr. Weld Blundell's travels, for I was up in the north with an ever-memorable expedition. But it is somewhat interesting—it has been interesting to me, at any rate—to hear what Mr. Blundell has had to say about the general characteristics of Adis Ababa and Abyssinia. It reminds one what a vast country is really included in Abyssinia, the last, I believe, of the independent kingdoms in Africa. The expedition of 1868 started from the Red sea by a very rough and uneven way through a defile, until we reached the plateau at a point called Sanafé, which, I was pleased to see, was very well placed in that ancient Portuguese map. From there our track led us south along a remarkable watershed, constituting a very peculiar geographical feature. On the one side, one could look down over the tributaries of the Nile to an endless vista of hills rolling away westward; on the other side, a tumbled mass of spurs stretched to the flat plains which intervened between the plateau and the sea. It was my luck to be sent to find if there was any road from that plateau down to the sea-coast which would not involve our passing through that terrible defile. I succeeded in getting to the coast, but I never found that road, and I believe myself no such road exists. There is no road from the coast to the plateau between Sanafé and the latitude of Magdala. But whilst Mr. Blundell has described scenery which reminded me very much of what we saw in Abyssinia, I must confess the photographs did not remind me of it at all. In his series of pictures you have seen a country of rolling

hills stretching down to forest rivers, a country of lakes and streams. Now, what I remember is a country of perfectly flat-topped hills, escarped in a most extraordinary way so as to make them almost inaccessible. The plateau was a true level plain along which we passed, and, looking from it on either side, you saw smaller plateaus broken off as it were, set in the landscape in irregular formation as far as you could see. I did not see anything of that in the pictures to-night, but I believe the general characteristics of Southern Abyssinia to be much the same as they are in the north. You will remember, I dare say, that the fortress of Magdala was placed on top of just such a hill as I have described; and had it not been for the mistaken views of Emperor Theodore, who constructed a road in order to get one of his field-pieces to the top—I think it was a mortar—we should never have been able to reach the summit of that plateau. This is only one of the many happy and fortuitous circumstances which enabled us to bring an expedition to a successful end which might have had a very different termination. Indeed, I believe that if any military expert were to have forecasted that expedition on the basis of such events as did actually occur, he would have been called a lunatic. But I fully agree with all Mr. Blundell has said about the climate of Abyssinia. In spite of that diurnal rain which we experienced in the north, as he did in the south, it was one of the most delightful climates I have ever experienced. It beat even the renowned climate of the Himalayas, and that, I think, is saying a great deal. Indeed, with such a climate as that, it can only be a matter of congratulation to the world at large that there really is a prospect of a railway being extended from the present system in the Somali country to the capital, Adis Ababa, where perhaps a friendly rival sanatorium to Khartum may be founded for invigorating the jaded European constitution. Still, if all I hear is true, I think there is a good deal to be done at Adis Ababa before it is likely to become anything like an ideal sanatorium. I can only congratulate Mr. Weld Blundell upon the exceedingly interesting show of pictures he has placed before us to-night. I think they are one of the best series of views I have seen in this hall.

Major GWYNN: I am afraid any remarks I can offer will be rather commonplace after the very interesting lecture of Mr. Weld Blundell. About three years ago I had the pleasure of travelling in Mr. Weld Blundell's footsteps over the route he traversed in 1898, and I can only take this opportunity of thanking him for the great assistance his map was to me. Not only did his map prove an assistance, but, along his route, the spirit of friendliness towards English people was very marked indeed—a thing not always common in Abyssinia at that time. Mr. Weld Blundell has told us a great deal about the position of the Gallas as regards the Abyssinians. Part of the time I was in Abyssinia, I saw a good deal of the Gallas near the country in which Mr. Weld Blundell chiefly travelled, and, though undoubtedly they had suffered from Abyssinian rule, yet at the same time one district furnished a great proof of the enlightenment of the government of the Emperor Menelik; although the subsidiary chiefs have inflicted a good deal of hardship on the Gallas and other people, the emperor himself cannot be held responsible for it. The district I mean was at the head of the Dabus river. When the Emperor Menelik invaded the country, he sent on messengers to the chief Galla offering him terms, which were very wisely accepted. Practical independence was guaranteed, and only a small tribute exacted. In consequence that district now is, I suppose, one of the most prosperous in Africa, and there are only about three or four Abyssinians employed in the districts as clerks. This country, after one has come out of the deserted and war-ravished plains of the Sudan, is a most extraordinary sight to see; the whole country is studded with farms, and the people are most prosperous. There is a large plateau, with wide open fields and quantities

of tillage. Lekempti, which Mr. Blundell mentioned, is something of the same sort of country, but it suffered from the passage of an Abyssinian army, and the people are much more oppressed. Nothing could exceed the attraction of the Galla country, and it reminds one of nothing more than a very thickly populated English park, if you can imagine a number of homesteads scattered about a park in England. Sir Thomas Holdich has remarked on the difference between the character of the plateau in northern Abyssinia and in the south, the difference of the rolling hill country and the flat-topped hills. Travelling along the Abyssinian frontier, I noticed the change was very marked when one got north of the Blue Nile along the frontier. The change takes place between 11° and 12° N. lat.

The PRESIDENT: If there is no one else present who would like to make any remarks on the paper, it only remains for us to give our hearty thanks to Mr. Weld Blundell for what I am sure you will all agree has been a most instructive and interesting address.

Mr. WELD BLUNDELL said: I beg to return my heartiest thanks for the patience with which you have listened to me. With regard to the remarks of the gentlemen who have spoken, I beg to remove any apprehension or idea in any one's mind that when I spoke of the Gallas being oppressed by the Abyssinians, I meant in the outlying districts where the Abyssinian chiefs are out of sight, not only of their immediate overlords, but of the Emperor Menelik. The emperor has an extraordinary sense, not only of justice, but punishes most rigorously any infringement or persecution. In the outlying countries of these enormous districts, it is almost impossible for even his long arm to reach, and the consequence is that some of these native chiefs, who have small ragamuffin armies, are able to commit atrocities in the way of extortion or other things that would be discountenanced or even punished severely even in Adis Ababa. Again I thank you very kindly for the way in which you have accepted my lecture.

SUGGESTIONS FOR AN INQUIRY INTO THE RESOURCES OF THE EMPIRE.*

By Prof. G. F. SCOTT ELLIOT.

THE suggestions which I have ventured to lay before the Research Department were originally formulated some time ago. It is not with any intention of finding fault or in a spirit of hostile criticism that I bring them forward.

No one can be more conscious than myself of the value of the surveys and investigations already made by commissioners and residents, under the Intelligence Department of the War Office, by the Colonial Governments themselves, and in recent years by the Imperial Institute, which has also been doing invaluable work. Already British India, Canada, and Australasia may be regarded as satisfactorily provided for in the way of maps. New Zealand, Mauritius, and several West Indian islands have already maps on the scale of 1 inch to the mile. The Surveyor-General of Natal has published a good map of Zululand on a scale of 5 miles; and, indeed, in places of 2½ miles to the inch. There

* Research Department, January 31, 1906.

is already a War Office map on the million scale (15·8 miles to the inch) for British Guiana and a part of British Africa.

Yet, even as regards this preliminary work, which is absolutely necessary for military purposes, we have not yet mapped the British Empire on a scale of 4 miles to the inch. For this reason only, these suggestions seem to deserve the most careful consideration. But a map on a scale of 4 miles to the inch is only a preliminary. A scientific survey should include far more than the mere geographical details. There is not yet such a survey of every colony as will show the forests, grasslands, mountain floras, and mountain woods. Are there maps which would show a geological prospector where he may possibly discover coal or gold or petroleum? Is there a map which will show an intending settler where he will find sheep, cattle, or cornland? Probably in Canada, Australia, and India these details are well known, but it is not probable that they are known or accessible in a great many other colonies. A map is necessary for all the purposes which have been mentioned. It is not for me to say what scale would be sufficiently large for army purposes. But obviously the first step is to get a map of the particular colony selected on a scale which will satisfy the War Office. This map should, of course, include geological information of a broad and general character, but it is for a geologist to decide how far and in what manner this might be most profitably attempted.

But one special object of the survey might be to ascertain the character of the vegetation over the whole of the colony. This study of the general character of vegetations, or modern œcology, can scarcely be said to have thriven in this country. Valuable work is, however, being done both in Leeds and Liverpool. The papers by Prof. Wm. Smith, Messrs. Lewis, Rankine, and Peal, published in the *Journal* are excellent and interesting, but unfortunately, if we except the late R. Smith's papers, Mr. Pearson's on the Ceylon Patanas, and a very small number of others, no other work has been done in this country; and indeed, the Americans threaten to survey Great Britain for us! Scandinavia, Russia, Germany, Austria, the United States, are rapidly piling up an enormous mass of literature, but in this country the authors mentioned, and a very few others, are, I really think, all who have published important works on the new lines.

Unfortunate and deplorable as is this fact, there is no difficulty in finding an explanation. There is no English text-book of this new science of vegetations, and we have been labelled with a barbarous and unintelligible name, viz. œcology. I shall try to show that is a valuable and important subject for research.

Whether jungle forest, light wood, thorn scrub, grass, or desert plants occupy a country, has always been known to depend entirely on the type of climate. Even primitive man was, I think, a good œcological botanist, and knew precisely what moss, wood, etc., meant. But the

splendid pioneer work of Warming and other Scandinavian botanists has made a science of what was previously a rough general idea, not formulated or described in a definite way. We know now, or rather we ought to know, exactly how to describe the natural vegetation in any of our colonies. From the type of vegetation it is possible to know what the climatic conditions are, *so far as regards plant life*, in a manner which was previously impossible. Those conditions, *so far as regards plant life*, tell us, with an approach to accuracy, exactly what plants and domestic animals are likely to thrive in a new unsettled part of any colony.

There are, of course, hundreds of valuable references in books of travel and reports published before the days of the study of vegetations. We should expect this to be the case, for the general character of the plants shows, even to any experienced non-scientific colonial, something of the prospects of cultivation. This study of vegetation is, in fact, to a great extent, common sense applied in a broad general way to the flora of a country. Hitherto botanists have, as a rule, never been able to understand a Wood as a whole, or as a living entity, because they were cataloguing the trees. European botanists have only recently studied Marsh and Moors, because hitherto they have, perhaps, lost themselves in the intricacies of Salix, or been overwhelmed by the genus Sphagnum. I have myself done too much of the dry thankless work of collecting and describing systematically not to be aware of the potential value of such work provided it be accompanied with full details. For my own part, my duty was to collect, and all my available time was occupied in that laborious task. Others have found themselves in the same position.

This new study of vegetations is of much greater importance, because it is so closely connected with practical agriculture. Thus, for example, in the colony of Rhodesia, it is quite certain that the tropical jungle of the Zambezi valley extends into Rhodesia. That tropical wet jungle, we know from experience in other parts of the world, is at present, perhaps, the most useless kind of country. There is, probably, along its border a fringe of more valuable monsoon forest. But a considerable proportion of Rhodesia is certainly temperate grasslands, and capable of tremendous development. A well-trained and experienced vegetation authority could mark out on a map the approximate boundaries of these vegetations. This would be of inestimable value.

I have been specially impressed by my own experiences, of which I shall particularize a few. In South Africa, the climatic regions are not even now definitely mapped off. In West Africa, I have never seen even an approximate sketch of the boundary of the wet jungle of the coast as distinguished from the light woods and grasslands of the interior. In East Africa, I am glad to see that the authorities have at last realized the importance for settlement of the fertile healthy grasslands on the

Mau plateau. It is true that there is no reason why they should have waited ten years before following out my suggestions, which were confirmed by every one qualified to judge, and which were by no means new even then. Yet I do not think any boundary has been drawn between (1) the healthy temperate grasslands, (2) the forests, (3) the thorn scrub, and (4) the Uganda plateau. There will undoubtedly be serious financial loss if these distinctions are not carefully mapped and thoroughly appreciated. The ordinary traveller describes, for instance, a wood, but this might be either a thorn scrub, a wet jungle, a tropical monsoon wood, or a temperate wood. The values and the prospects of these are as different as possible. Therefore, it seems to me that a map on which these vegetation zones are marked in a broad general way would be a most valuable production. For this survey a special colony might be selected, say Zululand or Rhodesia, by the Research Department of the Royal Geographical Society. Those who are entrusted with the survey, or with part of it, should be given all possible assistance, and especially with regard to observation of the sort of vegetation, and the marking off in a broad general way of grassland, wet jungle, marsh, true forest, etc.

The second part of my suggestion relates to the work which might be done at home. If any person wishes to get up the history and geography of any colony or district, he will probably take notes of the books and papers cited in the 'Statesman's Yearbook.' Then, if he is anxious to do the work thoroughly, he will consult the Card Catalogue in the Royal Geographical Society, which gives references to the 256 journals which refer to geography. Another very necessary point is to find out exactly what are the official Home or Colonial Government publications about the colony chosen. There must be, one would suppose, some theory in the minds of Government officials as to the way in which a private person is supposed *first* to find out, and *secondly* to see what has or has not been published by Government.

I have reflected and speculated on this subject, but I have never yet been able to discover what the theory is. At any rate, it is quite impossible for the earnest inquirer in the country to do either the one or the other, although those reports are nominally for sale at very low prices. It is exceedingly difficult to see them, and impossible to obtain them. Instead of charging 1*d.* or 2½*d.* for a report, the obvious reasonable course would be to increase the price, and to give any book-seller or newsagent double the ordinary trade discount for selling those reports. There is less difficulty in London, for he can consult the complete collection of the Royal Colonial Institute. The Royal Geographical Society also ought certainly to receive without payment every Government publication. But I do not think we get even some of those which are handed to every member of Parliament. If, however, the Society did receive every Government publication, then the cataloguing and

filing for reference would present no difficulty to us. This would render available to our members an enormous accumulation of valuable details.

Surely, for the sake of earnest inquirers in the country, all Government publications should be presented to every free library in the United Kingdom? Another excellent suggestion has been made to me, viz. that lists of geographical publications should be regularly supplied to all post offices. Then in the country one might have some chance of studying thoroughly. No private person can be expected to subscribe to the R.G.S., Royal Colonial Institute, Society of Arts, *Bulletin of the Imperial Institute*, *Kew Bulletin*, *Journal of the Board of Agriculture*, *Board of Trade Journal*, and many others as well. But, as must be obvious, the work at home of such a systematic survey is quite possible with the Card Catalogue of the R.G.S., the help of the Royal Colonial Institute, and of the Imperial Institute.

Why should this work be undertaken by the Research Department of the Royal Geographical Society? Because, undoubtedly, this work can be done better and more thoroughly by the Society than by any other body. The Society is able to obtain the support of both Home and Colonial Governments. But it is not obliged to carry on its business by the methods adopted by the British Government. Those methods, I think, are regarded with very moderate enthusiasm by those who have in any way experienced them. But the advantages of the Society's position at home and abroad are very great. Naval and military officers might, by its influence, obtain leave and some help to explore particular districts. Indian surveyors might be imported. Our Fellows resident in the district would, no doubt, assist to the best of their power. Moreover, the Society is in touch with those who have the means and desire to travel. A work of this sort is utterly beyond the reach of any private individual.

I will venture to give some practical details. Suppose that one colony, say Rhodesia or Zululand, has been chosen as a good subject for systematic inquiry. Then the first step would be for the Research Committee to place the entire direction of it in the hands of one man. There are always in London men of standing and position who have but recently returned from the colonies, and who would, I believe, take great pleasure in such work. The director should be supplied with a special clerk to work under his orders. At home it would be necessary to gather together as complete a list as possible of the literature dealing with the colony. It would be necessary to find out and state where the important books and papers can be seen. If money can be spared, it might be advisable to translate or to make an abstract in English of any important foreign works, especially if they are in difficult and unusual languages. Very soon it would be seen where information is lacking, and what parts of the colony require special exploration

or a detailed survey. Then it might be necessary to ask for help in surveying those unknown parts. No doubt a very large amount of assistance would be volunteered as soon as it was known that the Royal Geographical Society had undertaken such a task. The director would, of course, ask for help wherever it could possibly be given, and would be asked to report progress to the Research Department.

I am quite unaware if there are funds at the disposal of the committee for such purposes, and if there are such funds, I do not know their amount. But I do not think that there will be any lack of financial help when the character of the work is understood in the colony and at home. I am afraid a certain amount of obstruction would be encountered from those who already possess valuable special knowledge, and do not desire this to be generally accessible. Yet such obstruction from interested parties should not be an insuperable difficulty. Although I do feel the great importance of scientific geographical work of a highly technical nature, yet such an inquiry as this would be not only scientific, but of direct and immediate practical value. Its obvious practical advantage would bring the Society into closer touch with many prominent men both in the colonies and at home.

Before the paper, the CHAIRMAN: Mr. Scott Elliot is with us to-night to give us an address on a subject which is of rather unusual interest to the Society, and as I hope the paper will be followed by discussion, I will at once ask Mr. Scott Elliot to commence his address.

After the paper, the CHAIRMAN: Mr. Scott Elliot has made several very interesting suggestions which will no doubt lead to discussion, but I must ask you to remember the limitations of time. I will commence by asking Sir George Goldie to make a few remarks.

Sir GEORGE TAUBMAN GOLDIE: I am glad to speak because, as President of the Society, I would like to show the value that I attach to a great deal that is in Mr. Scott Elliot's paper. I agree with him in excluding India and Canada from our purview to-night, because in India there is the Government Survey, Forestry Department, and so forth; while in Canada there is the Geological Survey, which deals with various branches of science, and other similar institutions, which, I think, cover all that could at present be expected in the direction Mr. Elliot indicates. He mentions the want of maps in Natal during the war, and takes that as a basis for his thesis. I wish to say, having been on the War Commission, that there was a map of the north part as far as Ladysmith. It was not completed throughout Natal, owing to the difficulty of arranging with the Natal Government, which at the moment could not find the money for it. In those days, there was a feeling among some of the self-governing colonies, which one quite understands, of not liking to see independent survey work by officers from home. The Intelligence Department gave our commission an estimate as to what it would cost to make a survey of British Africa. They said that, if spread over twenty years, it would cost about £90,000 a year; that means about two millions altogether. It would not be a complete map, such as an œcologist or geologist would desire. We then asked what it would cost to survey all the unsurveyed portion of the British Empire;

they told us about £150,000 a year, or in all three millions. I wonder whether the present House of Commons would undertake that liability. It may be they would, and I certainly think we ought to press in that direction. We have to teach our compatriots that knowledge is economical, and ignorance very costly. The difficulty is how to get the public ear. Mr. Scott Elliot says that the public ought to know this and that, but how are you to reach them? Most people do not read advertisements; besides, they are costly. There are few things more difficult than to get a fact into the public mind. Mr. Scott Elliot told us that two of the great towns in the north of England are taking an interest in œcology. I need hardly say we sympathize with them, and applaud them. But I hope any results they obtain may be communicated quickly and freely to the Royal Geographical Society, so that there may be continuity of record and facility of reference.

Mr. Scott Elliot hopes he is not alone in his desire for systematic exploration. I have been fifteen years on the Council of this Society, and I can vouch that we have been fully alive to the necessity of systematic exploration. I can assure Mr. Scott Elliot that the œcologists will be supported by this Society. But I should add that during the last half of the nineteenth century more attention was necessarily paid to extensive exploration; it could not be otherwise. I venture to say that, although Mr. Scott Elliot did admirable work when he went to Ruwenzori, he would never have had an opportunity of going if there had not been H. M. Stanley and others who preceded him. I endorse many of Mr. Scott Elliot's views, but I would point this out, that some of them involve a great deal of expenditure. I should like to see the money spent, but we must obtain it first, and I hope we shall have support in pressing the Government for a large increase of our present derisory grant from the State—a grant made half a century ago when we were an infant and unproved Society.

Sir GEORGE WATT: I did not expect you would call upon me to speak, because my country (India) has been barred altogether from consideration. I have spent a considerable portion of my life in India, and what knowledge I possess on the subject of Mr. Scott Elliot's lecture is entirely concerned with that country. However, I shall in a very few words endeavour to convey some of the ideas that have passed through my mind both in reading the paper and listening to the remarks Mr. Scott Elliot has made, since my personal knowledge of the subject may probably help, if any department, such as has been sketched out, is ever actually made in connection with any colony. We are not exactly ignorant of the subject of œcology in India. We have a great Survey Department, a Forest Department, an Agricultural Department, a Geological Survey, a Botanical Survey, a Zoological Survey, an Archæological Survey, and a Reporter on Economic Products, and all sorts of learned societies. Still we have not, strictly speaking, commenced the work Mr. Scott Elliot recommends; we are only in the stage of preliminary scientific exploration which, as has just been suggested, should precede œcology. By way of illustrating my meaning, I may give one or two examples. If you imagine the Ganges and the Brahmaputra severing India into an eastern section, which has now become the new province of Eastern Bengal and Assam, from a western—the rest of India—you have a division which is a very curious and natural one. The great waterway separates characteristic vegetations in a very remarkable manner. For instance, on crossing the Ganges, the first point that might strike an observer would be the comparative disappearance of leguminous trees. On the other side, the western side, the *Acacia arabica* is exceedingly prevalent; across the Ganges it becomes exceedingly rare. That is related to a series of other facts, and brings out an idea with regard to the province of Eastern Bengal and Assam which is unique almost in Indian experience. Had

we gone into this subject carefully years ago, we might have seen that portions of Eastern Bengal and Assam were essentially countries for tea, and we should have saved no end of money and time had that idea come home to us. Eastern Bengal is essentially Chinese in its floral type. To be more correct, it is much closer to China than to India, and this comparison is not confined to its botany, but may be traced in its people, their customs, habits, and in some respects even their language, etc. For instance, in Eastern Bengal, the vegetable most largely grown, of the cabbage family, is a close ally to Chinese cabbage, and the original inhabitants, not the Bengali immigrants, all use vegetables which are often quite different from those on the other side of the Ganges. For instance, a chrysanthemum is a common vegetable there, but nowhere exists on the other side of the Ganges. One might multiply illustrations innumerable in order to show that there is something more than mere latitude, climate, geological structure of soil, or even humidity; there is something we do not understand. Some years ago at this Society I was called upon to speak in connection with a paper which was read by Major McGregor on an exploration from Assam into Burma. I then made a remark that seemed to cause a little excitement to the late Sir Henry Yule, who was present at the meeting. I said there was something in the botany of the eastern side of India that we had not yet explained, and I gave illustrations in the behaviour of the rhododendrons. In Manipur and the Naga hills the selfsame species are found at much lower altitudes than in Sikkim. Is œcology likely to deal with such phenomena? If so, it will render a great service to the world. Some few years ago I wrote a little paper in the *Agricultural Ledger* on "Crops in Relation to Climate." It seemed to attract some attention in the United States of America, and I was called upon by the Government of India to follow the matter up further. The keynote of my observations was that humidity was in India apparently a more potent factor than temperature. I gave an illustration, namely, if you were to start at Lahore, say in June, and fly across India in one day to the extreme south, you would see the land being prepared for wheat, being sown with wheat; you would see the wheat germinating, mature, being reaped, threshed, and being carried to market. As a consequence of this, we possess in India, under each crop, a series of forms suited to a multitude of conditions that is perfectly bewildering. After the most careful consideration and consultation with experts interested, I drew up and issued to every collector and magistrate in India, a circular letter in which they were called upon to give me returns with regard to the sowing and reaping of certain crops. A list of the crops of which particulars were wanted was printed, and a table supplied like a census return, calling for the dates of normal and extreme sowings and reapings. The returns duly came back to me, and were so voluminous that they ran to a volume of over a thousand pages. We are still, after five or six years, working at these returns, and hope, probably in the next ten years, to be in a position to publish the Report. Such, then, is one out of the many examples of œcological research that we in India have been endeavouring to prosecute, and such inquiries will have to be faced if Mr. Scott Elliot's theories are to be put to a final and practical test. I am afraid I should detain you too long to go into more illustrations, therefore I will only venture to add one or two words. Mr. Scott Elliot referred to a poisonous bean. I was one of the first of modern writers to draw attention to that subject. Of course it has been known from time immemorial, that the *Lathyrus sativus* pea, if eaten continuously for some time, will cause paralysis of the lower extremities. But a new feature seems to have arisen. A bean sent to England, which I believe to be *Phaseolus lunatus*, is said to have proved poisonous. Before accepting this view I should prefer to think there was a mistake somewhere, as the cultivated bean in question

has never before been suspected to be anything but perfectly wholesome. I will not say anything more, except to express my regret that this Society should say, if it does finally say, that India should be excluded. If we are going to have any such inquiry at all, let India be included by all means, and our scientific men will welcome a helping and encouraging hand. But we have nothing like the organization that would be indispensable to conduct an œcological survey. We should want an army of observers and workers that Government will, I fear, never give us unless a strong case can be made out for this new departure. By excluding us you are not giving us a helping hand, and we want the Royal Geographical Society to say this work is an important piece of work which should be done in India as well as in every other country, if such be the final opinion.

Mr. Scott Elliot: I have pleasure in testifying to the tremendous help Sir George Watt's dictionary has been to me in all my scientific work. I thank you very heartily.

Major Close: I think we are much indebted to Mr. Scott Elliot for having brought this subject to notice again. I wish to make a few remarks from the point of view of the official world. It is true that the only map we had of South Africa was of a little triangular bit of the north of Natal, and the reasons for that are reasons which I must not advert to. Perhaps it would be interesting if I say what is going on in Africa at the present moment, because I do not think the lecturer knows what is going on. We have a Survey Department properly organized on the Gold Coast. They have funds at their disposal, and the work is of a very accurate character. Next, we have a survey proceeding in the Orange River Colony, which, though perhaps not quite so rigorous, is sufficiently rigorous for the purpose of making a map on the scale mentioned by Mr. Scott Elliot. The scale it is actually working on is 2 miles to the inch, and they are turning out about 10,000 square miles a year. A survey has been approved of on systematic lines for British East Africa, and the organization of that is proceeding, and a commencement will be made in April next. The survey of Southern Nigeria and Lagos is to be systematized. Excellent work is being done in Uganda. The net result of all this is, that under instructions from the Colonial Office, the local governments in Africa are at the present moment spending over £40,000 a year, but since these surveys have only been commenced quite recently, it is too soon to expect many results just yet. We shall see those results in a few years. Most of these areas I have been speaking of were either crown colonies or protectorates —that is to say, colonies administered from home. But a self-governing colony runs its own show. If this Society could persuade the self-governing colonies in Africa, if it could persuade Natal to undertake a systematic survey, it would be of the greatest possible value to soldiers. The War Office has for many years past done its very best to encourage the mapping of the empire. No effort has ever been wanting on the part of the War Office to get maps made. Mr. Scott Elliot mentioned the question of scales. He said, "The first step is to get a map of the particular colony selected on a scale which will satisfy the War Office." The War Office will be satisfied with a scale of 2 or 4 miles to the inch, according to circumstances; or say 1 : 125,000 or 1 : 250,000. I do not know whether we have any definite proposition before the Research Committee, but if there is a definite proposition, it seems to me to be that the Society should undertake the exploration of either a portion of Rhodesia or Zululand. I think it would be a very excellent thing if the Society were to undertake the former.

Major Hills: I should like to make two or three remarks upon this subject. First of all, with regard to the general question of mapping the British possessions, I think that Mr. Scott Elliot has been unduly optimistic in his statements, because

he said that he thought that, though there were only very few maps published by the Intelligence Department of the War Office, they had probably a very large secret stock of maps. Now, I think I may say without divulging any official confidence that these secret stocks do not exist. The whole question of the maps was gone into before the war commission which Sir George Goldie has already quoted, and has been made public, and it would be only in the nature of a dangerous delusion for people to suppose that the War Office holds large numbers of secret maps which are not issued. As regards the general question which is before this meeting, I must confess I have rather a vague idea as to what the actual proposition is. It seems quite hopeless to suppose that the Society could do any perceptible amount of survey work. The President has given figures showing the cost of a survey of the British Empire or British possessions in Africa, and anybody who looks at those figures will see that a Society which has not many thousands a year to spend could not make great progress. Take, for instance, another example as illustrating this point. The Survey Department of India—that is, only the Trigonometrical and Topographical Surveys, independent of the Botanical, Mineralogical, and Geological Surveys, cost about a quarter of a million a year, and if you look at the area of India, you will see that you will have to multiply that sum several times over if you are going to do the whole empire on the same sort of scale. I do not see what the Society can do, even with a small country such as Zululand. They cannot carry out a survey of this nature—topographical, botanical, and geological—so as to complete it within any reasonable period of years. It seems to me that the right line of action for the Society is to bring pressure to bear upon the Government to spend more money upon the survey of the empire. I am going to say a thing which may be rather unpopular, but I really think it would be better if the Society, so to say, stuck to its own last and did not go outside the geographical question. I think if we go beyond that and enter into these commercial questions, questions relating to the economic vegetation of the country, or the geology or the mineralogy, we shall get beyond our legitimate sphere, which is the study of scientific geography. We are, I take it, not a commercial Society, and I think we had better not go into questions which are so directly commercial in their bearing. Our *rôle* in this matter is to make public as often and in as many directions as possible, the want of geographical surveys of the empire, and to lose no opportunity of impressing upon the Government and upon all public men the urgent necessity of carrying them out.

Mr. FITZGERALD: It has given me great pleasure to be present to hear Mr. Scott Elliot's remarks on a subject that should appeal to every one interested in the development of the commercial resources of our empire. I believe, however, the Imperial Institute does take up this subject, and that one can obtain information there, not only as regards products, but all Government publications as well. I am very glad that this subject has been ventilated, because there is no question more important than the increase of our knowledge of commercial geography. It is one in which I have always taken a very great interest, but, as Sir George Goldie has truly remarked, it is a most difficult matter to get the people of this country to evince the interest they should in this important question. I can speak from personal knowledge as to this, and I will give an instance in point. I gave some lectures last year in Lancashire on the great possibilities of the Sudan as a cotton-growing country. On one occasion a gentleman who was present came up after the lecture and expressed his astonishment that the Blue Nile was in the Sudan! I need not point out that the Blue Nile valley is one of its richest parts.

The Blue Books and reports that are published annually on the various parts

of our empire contain often most valuable information. They appear, are read by a select few, and then pass into undeserved oblivion, and it has always been a matter of great regret to me that the information they contain could not be gathered together and brought up to date. For instance, an administrator, on first going out to one of our comparatively new tropical possessions, spends a good deal of his own and his country's valuable time in obtaining information that is already available. Had he only been able to take out with him a condensed summary of the reports issued by his predecessors as to the capabilities and possibilities of the country, how much more valuable his own first report would be! I earnestly hope that the suggestion which has been advocated by Mr. Scott Elliot will be considered and not allowed to rest, and that the eminent gentlemen who are present will bring their knowledge and experience to bear upon it so that some definite and permanent result may be attained.

Dr. JOHN W. EVANS: I rise to say a few words about what is being done at the Imperial Institute in the direction which has been advocated by Mr. Scott Elliot. Prof. Dunstan, the Director, intended to be present, but he was detained at the last moment, and I must do my best to replace him.

In the first place, it is not enough to send out an expedition to survey a colony still comparatively undeveloped. It is impossible for even the most skilled specialists to investigate satisfactorily the problems that present themselves, and which are important for the determination of the lines on which the colony may be best developed, unless they have at their disposal the resources with which science has supplied us, and that are only fully available in technical establishments such as the Imperial Institute. It is not enough to report that iron or lead or manganese is present in considerable amount; the value of a deposit of iron or manganese is affected by minute amounts of certain impurities, while the question whether lead ore can be worked at a profit depends largely on the presence of a few ounces of silver in the ton. In regions that appear capable of agricultural development, the soil requires careful examination and analysis, and vegetable products, such as rubber, fibre, and essential oils, can only be properly investigated in adequately equipped laboratories. Not only have we the laboratories, but there is a staff of some two score of chemists, mineralogists, and botanists who are fully competent to deal with such questions as may arise. As Sir George Watt has referred to the subject of poisonous fodder plants, I may mention that we have already examined a number of these from different localities; the constituents have been determined, and, as far as possible, we have endeavoured to ascertain why this variety or that is poisonous, and in this connection have been supplied with detailed information as to the conditions under which they were grown (Dunstan and Henry, *Proc. Roy. Soc.*, 1901–04).

Besides examining the mineral and vegetable products forwarded to us, we have sent out specialists to make observations and gather materials. Three years ago Mr. Parkinson, a geologist of high reputation and a Fellow of this Society, and Mr. Huddart, a skilled mining engineer, commenced the mineral survey of Southern Nigeria and Lagos, which is still proceeding. They carry on exploration in the colony in the dry weather, and in the wet season they work out at the Imperial Institute their notes and specimens, the latter having meantime been analyzed by the chemists. Already results of importance have been obtained—deposits of coal, pitch, tin, and the mineral monazite, which furnishes thoria for our gas mantles, have been studied, and at the same time assistance has been afforded to the topographical survey. More recently a mineral survey has been organized in Northern Nigeria on similar lines under Mr. Falconer, formerly chief assistant to Prof. James Geikie.

Another member of our staff, Mr. Freeman, a well-known botanist, has also spent some time in Nigeria, and the materials he brought back have been investigated at the Imperial Institute. Still another, Mr. H. Brown, a chemist who has devoted special attention to rubber, visited the Bahr el Ghaza, and investigated the possibility of developing the rubber and other natural resources of the province. Again, Mr. Coomaraswanny, an able geologist, is working with an assistant in Ceylon, where the new mineral thorianite—far richer than monazite in thoria—has been discovered as the result of analyses at the Imperial Institute. At the present moment negotiations are in progress for other expeditions, and there seems no limit to the work that may be done if we are properly supported with funds.

I may add that the library of the Imperial Institute is well supplied with literature relating to the British colonies and dependencies, and we do our best to keep it up to date.

Sir GEORGE GOLDIE: Lest there should be any misunderstanding, I should like to say the Council of the Royal Geographical Society made a representation at the same time as the Royal Society. I shall not reply in detail to the remarks made with regard to the sphere of the Royal Geographical Society. That depends upon the question—what is geography?

The CHAIRMAN: It appears to me that the two questions before us to-night are, firstly, the possibility of putting more varied information on our maps than they contain already, which I think is one which will require much consideration. There is, for instance, a great deal of botanical information which obviously it would be impossible to include in any map whatever. And, secondly, whether the Society should assist in any way to the better distribution of such information as we possess. I agree with Sir George Goldie that it is exceedingly difficult to persuade people that they can get information if they only ask for it. As a matter of fact, between the Colonial Institute and the Royal Geographical Society, I take it that any explorer might equip himself with pretty nearly all the information he requires; but it is very necessary to advertise this fact, and I think that we might possibly do a little more than we are already doing towards making it known where the real sources of information lie. We ought seriously to consider whether we cannot give some practical outcome to the suggestions which have been made. What can the Society really do? I think that we might form a committee of the Research Department to consider in what direction we can work with the best chances of success, both as to making information known to those who require it, and as to giving assistance towards producing an economic map. We might try the experiment which Major Close has suggested, and see what comes of it. As regards Major Hills' remark that one quarter of a million is spent on the Survey of India, and his conclusion that it would require a very enormous expenditure to survey the whole of the empire, I do not think Mr. Scott Elliot proposes for an instant that all the empire should be surveyed as India has been surveyed. There are all sorts of surveys in India—geographical surveys, topographical surveys, trigonometrical and revenue surveys, which latter reach the scale of 24 inches to the mile. The first cost of making a geographical map is, I consider, nothing that should be prohibitive, even if we consider such a large question as the empire as a whole. I have had considerable experience in framing estimates for surveys of that class, and certainly should have thought it would not have cost nearly as much as the amount suggested by Sir George Goldie.

Sir GEORGE GOLDIE: I did not say it; that was the evidence put before us.

The CHAIRMAN: I should have thought it would have cost perhaps half of that. I will now ask Mr. Scott Elliot to reply to some of the criticisms that have been

offered to his paper, and then we must conclude by thanking him for giving us such a very interesting afternoon.

Mr. Scott Elliot: I must thank you very sincerely for the encouraging support which I have received from almost everybody who has spoken. First of all, with regard to expeditions of the Imperial Institute and of the Intelligence Department of the War Office. The more there are, the better I shall be pleased. But I wish earnestly to bring before the Research Department a very definite and distinct proposal that the Royal Geographical Society should itself undertake some colony and do it on these modern lines. There is, first of all, the difficulty of cost, but I would like to point out that if the Society were to approach any colony in the right spirit, and show that we simply wished to assist them to carry out a scientific survey, I fail to see where such a colony could find a reason for objecting. Then there is the difficulty of interesting the public. Now, some remarks of the last speaker explain precisely where that difficulty comes in. If we can make the public understand and realize that points of practical and commercial importance are solved by scientific treatment, then we shall no longer have any difficulty in interesting everybody. But there is a tendency in the science of this country to adopt an esoteric spirit, and to cut itself aloof from practical life, and then of course the public says that it cannot be bothered by scientific matters which do not explain anything that it wishes to know. I think our Society should most certainly keep in touch with practical men. I sincerely hope that the Research Committee will choose some colony, so that we can show what we can do when we have the chance of doing work on the very best modern scale.

Prof. Wyndham Dunstan, F.R.S., Director of the Imperial Institute, who was unable to be present, has written the following remarks:—

The valuable suggestion of Mr. Scott Elliot, that a systematic survey of the undeveloped portions of our empire should be undertaken in turn, is one which I hope will not be lost sight of. What is required is a definite scheme of operations determined upon by the various societies and bodies interested. We require a topographical survey, and a survey of the vegetable and mineral resources, of the climate and sanitary conditions of each of the regions, chiefly directed to the end of opening up these countries for the development of trade and commerce. Funds are required, but it will not be questioned nowadays that the cost of work of this character should be undertaken by Government. Large sums of money are annually expended on the administration of these countries, but until recently little or nothing has been expended in this economic work, which is a necessary preliminary to commercial development. The department chiefly concerned is the Colonial Office, under whose auspices the work could be best undertaken.

It is, however, obvious that such surveys will have little result unless the collected materials, vegetable and mineral, are submitted to full examination, especially from the chemical side, and then commercially valued and brought to the notice of the commercial community. By this means only will the expenditure be fully justified in the eyes of the Government, and a certain return in the shape of revenue secured.

An organization for accomplishing this working up of materials now exists, as Dr. Evans has pointed out, at the Imperial Institute. It deserves to be better known, and more liberally supported with funds. What it has accomplished in the last few years may be learned from its 'Bulletin' and published reports. Its work is carried on in close co-operation with the Colonial Office and the Colonial Governments concerned, but its permanent staff, numbering between thirty and forty skilled workers, is so small for the work it is called upon to do that but few of its members can be spared for the work of exploration on the spot which is so

necessary. Six men are, however, so engaged in the colonies at the present time, and it may be said that the economic survey of British West Africa is already well in hand. The Imperial Institute supplies the nucleus and permanent staff for dealing with the results of these surveys and this work, which can only be properly conducted in London. It remains to determine how the scheme of surveys is best arranged.

Through the Colonial Office as the controlling body, with the co-operation of the Royal Geographical Society, the London School of Tropical Medicine, and the Imperial Institute, an efficient plan of operations ought to be easy to arrange. But the ground to be covered is enormous, and, as Mr. Scott Elliot suggests, it will be prudent to take one country at a time. Personally, for many reasons, I should be inclined towards the selection of West Africa for the first action, and that because so much is already arranged on the proper lines for the initial development of that vast country.

[Prof. Wyndham Dunstan's support of my suggestions is extremely gratifying, and the Imperial Institute would be of an inestimable assistance to the survey. Yet I must protest strongly against his view that either the Colonial Office or the Imperial Institute could possibly conduct such a survey so well as the Royal Geographical Society. The Colonial Office has in the past, and will no doubt in the future, continue surveying and reporting, but no Government office could possibly undertake or control work of this nature. Otherwise such work would have been done long ago.—G. F. S. E.]

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

Part XI.—The Lochs of the Beauly Basin.

The Beauly basin is an important and extensive one, extending across almost the entire width of Scotland, from Beauly firth on the east coast to within about 4 miles from the shores of Loch Duich, and about 6 miles from the shores of Loch Carron, on the west coast. The basin is situated in a very mountainous district, many of the peaks in the central and western part of the basin exceeding 3000 feet, and some of them approaching 4000 feet, in height, while on proceeding eastward towards the outlet of the basin the land becomes gradually less elevated. On the southern boundary of the basin are Tigh Mor (3222 feet), Sgùrr nan Conbhairean (3634 feet), Garbh Leac (3673 feet), Sgùrr nan Ceathramhan (3614 feet), Ciste Dhubh (3218 feet), Carn Fuaraloch (3241 feet), and Sgùrr a' Bhealaich Dheirg (3378 feet); on the western boundary Beinn Fhada (Ben Attow), 3383 feet, Sgùrr nan

* Plates, p. 656.

Ceathreamhnan (3771 feet), Lurg Mhor (3234 feet), and Sgùrr Choinnich (3260 feet); on the northern boundary Sgùrr a' Chaoruinn (3452 feet), Bidean an Eoin Deirg (3430 feet), Maoile Lunndaidh (3294 feet), Sgùrr Fhuar-Thuill (3439 feet), Sgorr a' Choir-Ghlais (3552 feet), and Sgùrr Ruadh (3254 feet); while in the central part of the basin are Craig Dhubh (3102 feet), Sgùrr na Lapaich (3773 feet), An Riabhachan (3696 feet), Beinn Fhionnlaidh (3294 feet), Mam Sodhail (Mam Soul, 3862 feet), Carn Eige (3877 feet), Tom a' Choinich (3646 feet), a second peak named Sgùrr na Lapaich (3401 feet), and Tuill Creagach (3452 feet). Besides these heights there are many others which do

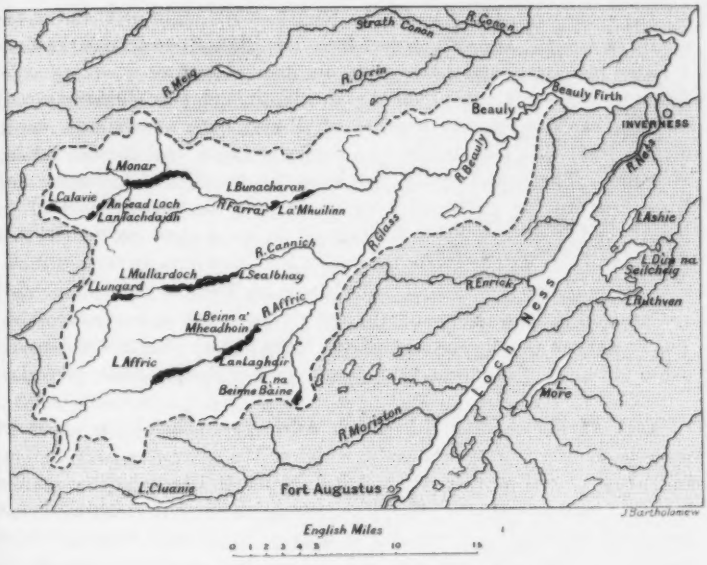


FIG. 1.—INDEX MAP OF THE BEAULY BASIN.

not attain the 3000-feet level. In the valleys between these chains of mountains lie the lochs which were sounded by the Lake Survey staff. In the most northerly valley, Glen Strath Farrar, there is the connected series consisting of Lochs Calavie, an Tachdaidh, an Gead, Monar, a' Mhuilinn, and Bunacharan; in the central valley, Glen Cannich, the connected series of Lochs Lungard, Mullardoch, and Sealbhag; and in the most southerly valley, Glen Affric, the connected series of Lochs Affric, an Laghair, and Beinn a' Mheadhoin; with the isolated Loch na Beinne Bàine as an outlier situated towards the head of Strath Glass. These valleys all trend in a more or less east-and-west direction, converging towards the north-east, where the river

Beauly is formed by the junction of the river Farrar with the river Glass. The river Glass is formed by the junction of the Amhuinn Deabhaidh (bearing the outflow from Loch na Beinne Bàine) with the river Affric, while the river Cannich is a tributary of the river Glass. The river-systems within the Beauly basin, and the relative positions of the different lochs, are shown on the accompanying index-map (Fig. 1). The area of the entire basin, as measured with the planimeter on the 1-inch Ordnance Survey maps, is about 343 square miles, of which about 215 square miles (or 63 per cent.) drain into these thirteen lochs, as will be seen from the summary table at the end of this paper. An inspection of the summary table shows, further, that all the lochs exceed half a mile in length, while eight of them exceed a mile in length; the two largest lochs (Mullardoch and Monar) exceed 4 miles in length, and have each an area exceeding a square mile. Seven of the lochs exceed 100 feet in depth, and two of them exceed 200 feet, the deepest one being Loch Monar with a maximum depth of 260 feet; this loch is also the one containing the largest volume of water. The boundary-line between the counties of Inverness and Ross runs up the centre of Loch Monar for the greater part of its length, and it crosses Loch Mullardoch in its central portion, so that these two lochs lie partly in Ross-shire and partly in Inverness-shire; four of the others (Lochs Lungard, Calavie, an Tachdaidh, and an Gead) are situated in Ross-shire, and the remaining seven in Inverness-shire. The scenery of the district around the lochs is very fine, and the trout-fishing in most of the lochs very good; some of them contain pike also.

Loch Affric (see Plate I.).—Loch Affric (or Affaric) lies about 26 miles to the south-west of Beauly, which is the nearest railway-station, and about 11 miles from Glen Affric Hotel at Cannich, the nearest house of entertainment. The loch trends in a west-south-west and east-north-easterly direction, and is nearly $3\frac{1}{4}$ miles in length. It is broadest towards the western end, where the maximum breadth is nearly half a mile, narrowing gradually, though irregularly, on proceeding towards the eastern end, the mean breadth of the entire loch being a quarter of a mile. The superficial area is about 526 acres, or over four-fifths of a square mile, and the area drained by the loch is nearly 47 square miles. The maximum depth of 221 feet was observed near the centre of the loch. The volume of water is estimated at 2146 millions of cubic feet, and the mean depth at nearly 94 feet. The loch was surveyed on October 6 and 7, 1903, when the elevation of the lake-surface above the sea was determined by levelling from bench-mark as being 747·0 feet; when levelled by the officers of the Ordnance Survey on July 3, 1867, the elevation was found to be 744·1 feet above sea-level, or 3 feet lower than 1903.

Loch Affric is quite simple in conformation, the deeper water

occupying a central position, from which the bottom slopes upward to the shores on all sides. The 50-feet contour coincides approximately with the outline of the loch, enclosing a basin nearly 2½ miles in length, approaching comparatively close to the west end, but distant more than a quarter of a mile from the east end. Separated from this main 50-feet basin by shallower water is an isolated sounding of 54 feet, near the east end where the main loch is joined by the little subsidiary basin called Loch Pollan Fearna, in which a maximum depth of 30 feet was observed. The 100-feet basin is 2¼ miles in length, and the 150-feet basin nearly 1½ miles in length, approaching in each case nearer to the west end than to the east end. The 200-feet basin is about three-quarters of a mile in length, and is approximately equidistant from both ends of the loch, but the deepest sounding in 221 feet was taken towards the west end of the basin, and therefore nearer to the western end of the loch. A section along the centre of the loch from end to end is shown in the longitudinal section A–B on the map, and a section across the loch in the position of the deepest sounding is shown in cross-section C–D. This last section shows a very slight irregularity in the deepest part of the loch, where a sounding in 209 feet was taken between a sounding in 211 feet on the one hand, and the greatest depth of the loch (221 feet) on the other. Another line of soundings, about three-quarters of a mile further east, shows a shoaling in deep water, where a depth of 122 feet was recorded between a depth of 130 feet on one side, and 159 feet on the other. With these exceptions, the various lines of soundings show a regular bottom, with a steep off-shore slope in some places along both the northern and southern shores. Thus, proceeding along the northern shore from the east end of the loch, the first line of soundings gave a depth of 40 feet at a distance of 20 feet from shore; the fourth line of soundings gave a similar depth at a similar distance; the fifth line gave a depth of 28 feet at 10 feet from shore; the ninth line gave 47 feet at 30 feet; the next line gave 21 feet at a distance of 20 feet; the next line 84 feet at 60 feet distance; the next 35 feet at 25 feet distance; and the next line 36 feet at 30 feet distance. In like manner proceeding along the southern shore from the east end, the sixth line of soundings gave a depth of 76 feet at a distance of 50 feet from shore; the next line gave 31 feet at 20 feet distance; the next line 47 feet at 15 feet distance; the next line 33 feet at 20 feet distance; and the next line 34 feet at 30 feet distance. All these figures indicate a slope exceeding 1 in 1, and in one case a slope exceeding 3 in 1. The following table gives the areas between the consecutive contour-lines at intervals of 50 feet, with the percentages to the total area of the loch, the flat-bottomed character of the basin being indicated by the larger zone on the deeper side of the 100-feet contour than on the shallower side:—

Feet.		Acres.		Per cent.
0 to 50	... ...	195	...	37
50 „ 100	... ...	89	...	17
100 „ 150	... ...	125	...	24
150 „ 200	... ...	70	...	13
Over 200	... ...	47	...	9
		526		100

Temperature Observations.—A series of temperatures taken at 3 p.m. on October 6, 1903, in the deepest part of the loch, gave the following results:—

Surface	49°·2 Fahr.
10 feet	48°·9 „
25 „	48°·6 „
50 „	48°·0 „
100 „	47°·0 „
150 „	45°·6 „
200 „	44°·8 „

The extreme range shown by these observations is only 4°·4 from surface to bottom, the fall of temperature being very gradual.

Loch an Laghair (see Plate II.).—Loch an Laghair lies a little over a mile to the north-east of Loch Affric, and is practically continuous with Loch Beinn a' Mheadhoin, for normally the two lochs stand at the same level, although an easterly gale sets up a strong current through the narrows at Blàr an Àth, in which a depth of 5 feet was observed. The loch trends in a north-east and south-west direction, and is nearly two-thirds of a mile in length. The maximum width exceeds a quarter of a mile towards the western end, whence the loch narrows gradually towards the eastern end. The superficial area of the loch is about 83 acres, and the area draining directly into it nearly 6 square miles, but since it receives the overflow from Loch Affric its total drainage area is about 52½ square miles, an area over four hundred times greater than that of the loch. The deepest sounding in 100 feet was taken in the central part of the loch, but rather nearer to the north-east end. The volume of water is estimated at 135 million cubic feet, and the mean depth at 37½ feet. The loch was surveyed on October 6, 1903; but the elevation of the lake-surface above the sea could not be determined by levelling, as there was no bench-mark near the loch. The level was estimated at about 703 feet above sea-level.

Loch an Laghair forms a simple basin, the shallower contours coinciding approximately with the outline of the loch, but approaching closer to the northern shore in the eastern half of the loch, where the off-shore slope is steepest. The western end is apparently being silted up. The 75-feet area is extremely small, for on each side of the deepest sounding in 100 feet, at a distance represented by twenty strokes of the oar, the depths were 66 and 64 feet respectively. A section across the loch at the position of the deepest sounding is shown

in cross-section E–F on the map, and a section along both Loch an Laghair and Loch Beinn a' Mheadhoin is shown in the longitudinal section A–B. The area of the lake-floor in Loch an Laghair covered by less than 50 feet of water is about 63 acres, or 76 per cent. of the total area of the loch. The temperature of the surface water at 3.30 p.m. on the date of the survey was 48°·0 Fahr., the air-temperature being 42°·0.

Loch Beinn a' Mheadhoin (see Plate II.).—Loch Beinn a' Mheadhoin (or Beinnavian or Beneveian) trends generally in a north-east and south-westerly direction, and is over 2½ miles in length. The loch is fairly uniform in width, the two end portions being somewhat narrower than the central portion, which has a maximum breadth of nearly half a mile, the mean breadth of the entire loch exceeding a quarter of a mile. The superficial area of the loch is about 504 acres, or over three-quarters of a square mile, and the area of land draining directly into it is about 15½ square miles; but since it receives the superfluent waters from Lochs Affric and an Laghair, the total drainage area is about 68 square miles. The maximum depth of 167 feet was observed in a central position, but nearer to the eastern than to the western end of the loch. The volume of water is estimated at 1435 millions of cubic feet, and the mean depth at over 65 feet. The loch was surveyed on October 6, 1903; but the elevation of the lake-surface above the sea could not be determined by levelling. The water in the loch was very high on the date of the survey, the level then being estimated at about 703 feet above sea-level, but the normal level is probably about 700 feet.

Loch Beinn a' Mheadhoin is rather complex in conformation, including as it does three deep basins separated by shallower water. Near the western end of the loch is a small basin having a maximum depth of 95 feet, and near the eastern end is a larger basin having a maximum depth of 117 feet, while the largest and deepest basin occupies the central portion. The two ridges separating these three basins may be due to the deposition of material brought down by the streams entering the loch at these places along the northern shore, of which the westerly stream (Amhainn a' Ghlinne Fhiadhaich) is the more important; the maximum depth observed on the western ridge was 69 feet, and on the eastern ridge 97 feet. The 25-feet and 50-feet contours are continuous from end to end of the loch, while the 75-feet contour is broken at the position of the western ridge, and the 100-feet contour is broken at the position of the eastern ridge. The eastern 100-feet basin is nearly half a mile in length, and the main 100-feet basin nearly 1½ miles in length; within the last-mentioned basin is a long narrow 150-feet basin, based on soundings of 159, 167, and 154 feet, with an isolated sounding in 156 feet a quarter of a mile farther west. It

seems doubtful whether this isolated sounding may not be connected with the principal basin by deep water, and in that case the 150-feet basin would be nearly a mile in length. The deepest sounding in 167 feet was recorded about a mile from the eastern end of the loch, and about 1¼ miles from the western end. The cross-section C–D, in this position, shows a steeper gradient off the northern than off the southern shore; but the soundings, as a whole, afford no evidence of any very steep slopes. The deeper part of the loch has quite a flat-bottomed character, as indicated by the figures in the following table, giving the areas between the consecutive contour-lines :—

Feet.		Acres.		Per cent.
0 to 25	...	98	...	19·5
25 to 50	...	80	...	15·8
50 to 75	...	96	...	19·0
75 to 100	...	174	...	34·5
Over 100	...	56	...	11·2
		504		100·0

It will be observed that the largest zone is the one between 75 and 100 feet, and that the area of the lake-floor covered by less than 50 feet of water is about 178 acres, as compared with 270 acres covered by water between 50 and 100 feet in depth, or 35 per cent. as compared with 53 per cent. In most lakes the arrangement is the reverse of this, the areas between consecutive contour-lines drawn at equal intervals, usually decreasing with increase of depth. The temperature of the surface water at the east end on commencing the survey was 50°·0 Fahr., the temperature of the air being 42°·5, while later in the afternoon, towards the opposite end the surface temperature was 49°·5; but, an easterly gale having sprung up, it was found impossible to take serial temperatures beneath the surface.

Loch na Beinne Bàine (see Plate V.).—Loch na Beinne Bàine lies in Guisachan forest, about 4 miles to the south-east of Loch Beinn a' Mheadhoin, and 8 or 9 miles to the west of Invermoriston on Loch Ness. It is irregular in outline, trends in a north-north-east and south-south-westerly direction, and is nearly a mile in length, with a maximum breadth of nearly half a mile. The superficial area is about 154 acres, or a quarter of a square mile, and the area draining into it about 1½ square miles. The maximum depth of 67 feet was observed about a quarter of a mile from the southern end of the loch, midway between an island of stones and the eastern shore. The volume of water is estimated at 190 million cubic feet, and the mean depth at 28⅓ feet. The loch was surveyed on June 6, 1904, but the elevation of the lake-surface above the sea could not be determined; the height of the water at the sluice was about 2 feet, and at one time the loch appears to have been considerably higher.

Loch na Beinne Bàine forms a simple basin; the 25-feet contour coincides approximately with the outline of the loch, but is deflected at the position of the island of stones off the western shore towards the southern end, while the 50-feet basin, based on soundings of 67, 64, 54, and 52 feet, is contained in the southern half of the loch, and is about a quarter of a mile in length. The soundings indicate in one or two places slight undulations of the lake-floor, but as a rule the slope of the bottom is regular and gentle. The area covered by less than 25 feet of water is about 95 acres, or 62 per cent. of the total area.

Temperature Observations.—A series of temperatures taken in the deepest part of the loch gave the following results :—

Surface	60°·8 Fahr.
10 feet	60°·0 „
20 „	50°·5 „
40 „	47°·6 „
60 „	46°·5 „

These observations indicate an extreme range of temperature from surface to bottom amounting to 14°·3, there being a fall of 9°·5 between 10 and 20 feet, which is nearly equal to a fall in temperature of one degree per foot of depth. Reference has elsewhere been made to the large range and rapid fall of temperature observed in Lochs Monzievaird, Achilty, and Dubh,* and the temperatures here given from Loch na Beinne Bàine afford another instance for comparison.

Loch Lungard (see Plate V.).—Loch Lungard (or Longart, or Glasletter) lies at the head of Glen Cannich, about 5 miles to the north of Loch Affric. It trends east and west, and is $1\frac{1}{2}$ miles in length, with a maximum breadth towards the west end of one-third of a mile, whence the loch narrows gradually towards the east. The superficial area is about 216 acres, or one-third of a square mile, and the area draining into it is nearly 23 square miles. The maximum depth of 129 feet was observed in a central position, but towards the east end. The volume of water is estimated at 599 million cubic feet, and the mean depth at nearly 64 feet. The loch was surveyed on October 7, 1903, when the elevation of the lake-surface above the sea was found by levelling from bench-mark to be 761·3 feet, which is nearly identical with the level observed by the Ordnance Survey officers on October 14, 1867, viz. 761·2 feet. When surveyed the water was about its normal level, and in floods might rise about 3 feet.

Loch Lungard is extremely simple in conformation, the bottom sloping down on all sides towards the deepest part, not the slightest irregularity being indicated by the soundings, while the contour-lines coincide approximately with the outline of the loch. This is shown in

* See *Geogr. Journ.*, vol. 26, pp. 55, 56, July, 1905.

both the longitudinal section A–B and the cross-section C–D on the map. The 50-feet basin is 1¼ miles, and the 100-feet basin rather under a mile, in length, and they are comparatively wide, so that the loch is of a flat-bottomed character, as is shown by the following table, giving the areas and percentages between the contour-lines :—

Feet.	Acres.	Per cent.
0 to 50	87	40
50 „ 100	81	38
Over 100	48	22
	216	100

Temperature Observations.—The following series of temperatures, taken at 2 p.m. on the date of the survey in the deepest part of the loch, indicates a range of only 1°·2 Fahr. throughout the body of water :—

Surface	49°·2 Fahr.
25 feet	49°·0 „
50 „	48°·8 „
125 „	48°·0 „

Loch Mullardoch (see Plate III.).—Loch Mullardoch (or Mulardich, or Moyley) lies less than 2 miles to the east of Loch Lungard, and is practically continuous with Loch Sealbhag, there being a small expansion of the river between them called Loch Ath a' Bhàn, which was not sounded. Loch Mullardoch trends generally in an east and westerly direction, and is somewhat irregular in outline, with a slight bend in the central portion. It exceeds 4 miles in length, and is pretty uniform in width, the maximum breadth being less than half a mile, and the mean breadth over a quarter of a mile. Its waters cover an area of about 756 acres, or considerably more than a square mile, and the area draining directly into it is about 27½ square miles; but since it receives the outflow from Loch Lungard its total drainage area exceeds 50 square miles. The maximum depth of 197 feet was observed in the eastern portion of the loch, about a mile and a half from the east end. The volume of water is estimated at 2553 millions of cubic feet, and the mean depth at 77½ feet. The loch was surveyed on October 7, 1903, but the elevation above the sea was not determined; when levelled by the Ordnance Survey officers on November 29, 1866, the elevation of the lake-surface was found to be 704·9 feet above sea-level. On the date of the survey the water was about a foot above the normal level, and two days previously it had been 3 feet higher.

Loch Mullardoch is divided into two deep basins by a shoaling of the water in its central portion, where there is a constriction and bend in the outline, the maximum depth in the western basin being 150 feet, and in the eastern basin 197 feet, the depth on the shoaling being 80 feet. A section across the deepest part of the western basin is shown in

cross-section C–D, and one across the deepest part of the eastern basin in cross-section E–F, on the map, and a section along the centre of the loch from end to end is shown in the longitudinal section A–B at the foot of the map. This last-mentioned section brings out the central shoaling referred to, which is apparently traceable to the influence of the streams entering on both sides of the loch at this place, and principally of the Allt Taige, at the mouth of which, on the northern shore, is a considerable delta. The 50-feet contour is continuous, and encloses a basin nearly 4 miles in length. The western 100-feet basin exceeds half a mile in length, separated by an interval of over half a mile from the eastern 100-feet basin, which is one and a half miles in length, and includes a 150-feet basin over a mile in length. All the cross-lines of soundings show a regular bottom, the water deepening gradually from the shore towards the centre, with a steep off-shore slope in some places, as, for instance, along the southern shore off Creag Dubh, where a sounding in 24 feet was taken about 20 feet from shore, and off Creag a' Bhaca, at the deepest part of the loch, where a sounding in 94 feet was taken about 100 feet from shore. The following table gives the approximate areas between the consecutive contour-lines at intervals of 50 feet, and the percentages to the total area of the loch, and indicates the flat-bottomed character of the basin, the comparatively large area of the lake-floor covered by more than 150 feet of water being noteworthy :—

Feet.	Acres.	Per cent.
0 to 50	298 ...	39
50 „ 100	228 ...	30
100 „ 150	121 ...	16
Over 150	109 ...	15
	756	100

Temperature Observations.—The following series of temperatures, taken at 4.30 p.m. on the date of the survey in the western basin, shows that the water was nearly uniform in temperature, the extreme range from surface to bottom being only 1° Fahr., the readings down to a depth of 50 feet being identical :—

Surface	50°·0 Fahr.
10 feet	50°·0 „
25 „	50°·0 „
50 „	50°·0 „
100 „	49°·5 „
150 „	49°·0 „

Loch Sealbhag (see Plate III.).—Loch Sealbhag lies to the east of, and is, as already stated, practically a continuation of Loch Mullardoch. It trends in a north-east and south-westerly direction, and is two-thirds of a mile in length, with a maximum breadth towards the west end of nearly a quarter of a mile, whence it narrows gradually towards the

north-east. Its waters cover an area of about 68 acres, and it drains directly an area of $3\frac{1}{2}$ square miles, but since it receives the outflow from Lochs Lungard and Mullardoch, its total drainage area is nearly 54 square miles—an area nearly five hundred times greater than that of the loch. The maximum depth of 56 feet was observed in the widest part of the loch towards the western end, and comparatively near the southern shore. The volume of water is estimated at 61 million cubic feet, and the mean depth at over $20\frac{1}{2}$ feet. The loch was surveyed on October 5, 1903, but the elevation above the sea could not be determined.

The wide western portion of Loch Sealbhag includes a deep basin exceeding 30 feet in depth, which approaches comparatively close to the western end, and is over a quarter of a mile in length. To the north-east of this basin the bottom rises, and falls again on approaching the outfall to a depth of 31 feet, the depth on the rise being 16 feet. The area of the lake-floor covered by less than 20 feet of water is about 39 acres, or 57 per cent. of the total area. The temperature of the surface water on the date of the survey was 50°·5 Fahr.

Loch Calavie (see Plate V.).—Loch Calavie (or Calvie) lies about 6 miles to the north-west of Loch Lungard, and only 7 miles from the head of Loch Carron on the west coast of Scotland, at a high elevation among the mountains, the lower slopes of which are covered with peat. The loch trends in a north-west and south-easterly direction, and is considerably over a mile in length, with a maximum width towards the western end exceeding one-third of a mile, whence the breadth gradually decreases on approaching the eastern end. The superficial area is about 167 acres, or a quarter of a square mile, and the area draining into it nearly $2\frac{1}{2}$ square miles. The maximum depth of 84 feet was observed in a central position, but rather nearer the western than the eastern end. The volume of water is estimated at 276 million cubic feet, and the mean depth at 38 feet. The loch was surveyed on October 19, 1904, when the elevation was found by levelling from bench-mark to be 1128·35 feet above the sea—a little lower than the elevation as determined by the Ordnance Survey officers on August 14, 1866, viz. 1128·5 feet above sea-level.

Loch Calavie is perfectly simple in conformation, the contour-lines coinciding approximately with the shore-line, though in each case they approach nearer to the western than to the eastern end of the loch, so that the average slope is steeper towards the head of the loch. This is shown in the longitudinal section A–B on the map. The 25-feet basin is nearly a mile, and the 50-feet basin three-quarters of a mile, in length. The soundings give no indication of any steep off-shore slopes, and the average slope between the 25-feet and 50-feet contours

is less steep than in shallower water, as indicated in the following table by the larger area beyond the 25-feet line :—

Feet.	Acres.	Per cent.
0 to 25	55 ...	33
25 „ 50	62 ...	37
50 „ 75	39 ...	24
Over 75	11 ...	6
	167	100

Temperature Observations.—The following series of temperatures taken in the deepest part of the loch shows that on the date of the survey the whole body of water was practically uniform in temperature, the extreme range being less than 1° Fahr. :—

Surface	47°·0 Fahr.
40 feet	46°·3 „
75 „	46°·2 „

Loch an Tachdaidh (see Plate V.).—Loch an Tachdaidh lies about 2 miles to the east of Loch Calavie, and is almost continuous with Loch an Gead, the stream between them being a very short one, and the difference in level only 1½ feet. The term Gedd Lochs is applied to the connected series, consisting of Loch an Gead, Loch an Tachdaidh, and the neighbouring little Loch an Gobhlach, which was not sounded. Loch an Tachdaidh is irregular in outline, trends in a north-east and south-westerly direction, and is nearly two-thirds of a mile in length, with a maximum breadth exceeding one-third of a mile. Its waters cover an area of about 92 acres, and it drains directly an area exceeding 4 square miles, but since it receives the overflow from Loch Calavie, its total drainage area is over 6½ square miles. The maximum depth of 62 feet was observed in the centre of the north-eastern portion of the loch, near a heap of stones, showing above the surface of the water. The volume of water is estimated at 72 million cubic feet, and the mean depth at 18 feet. The loch was surveyed on October 21, 1904; the elevation could not be determined by levelling, but was estimated at about 831·5 feet above the sea.

Loch an Tachdaidh is irregular in conformation as well as in outline, and, besides the island of stones already mentioned, includes four small unnamed islands, the largest of which occupies a central position; the south-western portion is shallow and filled with weeds. The contour-lines are sinuous in character, the deepest part lying between the largest island and the heap of stones, where three soundings exceeding 50 feet in depth were taken. To the south of the largest island, and towards the eastern shore, a sounding in 25 feet was recorded, surrounded by shallower water. The area of the lake-floor covered by less than 25 feet of water is about 74 acres, or 81 per cent. of the total area. The following series of temperatures taken in the position of

the deepest sounding shows a range of only 1°·2 Fahr. throughout the body of water, the deeper layers being uniform in temperature:—

Surface	46°·2 Fahr.
30 feet	45°·0 „
60 „	45°·0 „

An Gead Loch (see Plate V.).—An Gead loch lies to the north-east of Loch an Tachdaidh, and trends in a similar direction, but is more regular in outline and more uniform in width. An Gead loch is nearly $1\frac{1}{4}$ miles in length, with a maximum width towards the south-west end of a quarter of a mile. The superficial area is about 110 acres, and the area draining directly into it is about $2\frac{1}{2}$ square miles, but since it receives the outflow from Lochs Calavie and an Tachdaidh, the total drainage area exceeds 9 square miles. The maximum depth of 30 feet was observed towards the north-eastern end of the loch. The volume of water is estimated at 54 million cubic feet, and the mean depth at $11\frac{1}{4}$ feet. The loch was surveyed on October 21, 1904, and the elevation was estimated at about 830 feet above sea-level. The bottom of an Gead loch is irregular and stony, so much so that in the deeper part no mud could be got, while the shallow western portion is covered with sand. Though irregular, the basin has a flat-bottomed character, for the majority of the soundings were taken in depths exceeding 10 feet, and only three soundings in depths exceeding 20 feet. The area of the lake-floor covered by more than 10 feet of water is about 62 acres, or 56 per cent. of the total area. The temperature of the water was nearly uniform on the date of the survey, a reading at the surface giving 46°·7 Fahr., and a reading at 25 feet 46°·0.

Loch Monar (see Plate IV.).—Loch Monar lies at the head of Glen Strath Farrar, little more than a mile to the north-east of an Gead loch, and is one of the most important lochs in the Beauly basin. In length and in superficial area it is slightly inferior to Loch Mullardoch, but it is the deepest of the series, and contains the largest volume of water. The general trend of Loch Monar is east and west, but with a slight sinuosity in the outline, the length exceeding 4 miles. The width varies considerably, the maximum breadth of nearly half a mile occurring near the west end, the mean breadth of the entire loch exceeding a quarter of a mile. The waters of the loch cover an area of about 750 acres, or over one square mile, and the area draining directly into it is about 41 square miles, but since it receives the overflow from Lochs Calavie, an Tachdaidh, and an Gead, the total drainage area is about 50 square miles. The maximum depth of 260 feet was observed much nearer the eastern than the western end. The volume of water is estimated at 3213 millions of cubic feet, and the mean depth at $98\frac{1}{3}$ feet. The loch was surveyed on October 10, 1903, when the elevation of the lake-surface above the sea was found

to be 663·9 feet; when levelled by the officers of the Ordnance Survey on June 20, 1866, the elevation was 662·8 feet above sea-level. At the time of the survey the water was about its normal level, and might rise to the extent of several feet.

Loch Monar is quite simple in conformation, all the contour-lines enclosing continuous areas, and the cross-lines of soundings indicating a regularly sloping bottom from the shores out towards the centre of the loch. The longitudinal section, A–B on the map, along the centre of the loch from end to end shows slight undulations of the lake-floor, the shallowings coinciding with constrictions in the outline. The contour-lines all approach nearer to the eastern than to the western end of the loch, showing a steeper slope in an easterly direction from the deepest sounding, which was taken less than a mile from the east end, or one-fourth of the distance from one end to the other. The off-shore slope is in places very steep, especially along the southern shore at the deepest part of the loch, where near the centre of the loch a sounding in 104 feet was taken about 120 feet from shore; a little farther east another sounding in 50 feet was taken about 50 feet from shore; still farther east a sounding in 148 feet was taken about 120 feet from shore; and still farther east a sounding in 87 feet about 60 feet from shore. The last-mentioned sounding, which gives a slope of 29 in 20, was taken on the cross-line immediately to the east of the deepest sounding, and the steepest gradient observed off the northern shore was at the opposite end of the same line, where a sounding in 54 feet was taken at about 60 feet from shore. The cross-section C–D on the map is taken at the position of the deepest sounding, and shows a gentle off-shore slope, succeeded by a steeper slope on proceeding into deep water, the deeper part of the loch being of a flat-bottomed character. The area enclosed by the 50-feet contour is nearly $3\frac{1}{2}$ miles in length, being distant from the west end nearly three-quarters of a mile, and extending into the narrow part at the east end off Creag Ghràda; in the expansion of the out-flowing river, opposite Creag Dhubh, a depth of 64 feet was observed. The 100-feet basin is 3 miles, the 150-feet basin $2\frac{1}{2}$ miles, and the 200-feet basin over one mile, in length. The approximate areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are given in the following table, from which it will be noticed that the area of the zone between 150 and 200 feet is larger than that of the two preceding shallower zones :—

Feet.	Acres.	Per cent.
0 to 50	293 ...	39
50 „ 100	134 ...	18
100 „ 150	99 ...	13
150 „ 200	138 ...	18
Over 200	86 ...	12
	750	100

Temperature Observations.—The following series of temperatures, taken in the deepest part of the loch at 4 p.m. on the date of the survey, shows that the whole body of water varied little in temperature, being, in fact, uniform in temperature down to 100 feet, the extreme range amounting to only 1°·2 Fahr.:—

Surface	... ...	49°·5 Fahr.
10 feet	... ...	49°·5 „
25 „	... ...	49°·5 „
50 „	... ...	49°·5 „
100 „	... ...	49°·4 „
150 „	... ...	49°·0 „
170 „	... ...	48°·5 „
200 „	... ...	48°·3 „

Loch a' Mhuilinn (see Plate V.).—Loch a' Mhuilinn (or Moilie) is a small irregular loch lying about 5 miles to the east of Loch Monar. A terrace of gravel surrounds the loch, except on the northern shore, where the hill An Carnach rises steeply from the lake-shore. There is a large island named Eilean a' Mhuilinn near the east end, and two smaller islands at the mouth of the inflowing river at the west end. The loch trends in an east-north-east and west-south-westerly direction, and is nearly a mile in length, with a maximum breadth in the centre exceeding one-third of a mile, whence it narrows towards the two ends. The superficial area is about 100 acres, and the area of land draining directly into it is about $37\frac{3}{4}$ square miles, but since it receives the overflow from Lochs Monar, an Gead, an Tachdaidh, and Calavie, its total drainage area is nearly 88 square miles—an area 550 times greater than that of the loch. The maximum depth of 94 feet was observed in the wide part of the loch towards the northern shore. The volume of water is estimated at 150 million cubic feet, and the mean depth at over 34 feet. The loch was surveyed on October 12, 1903, when the elevation was determined by levelling from bench-mark as being 417·65 feet above the sea; when visited by the Ordnance Survey officers on June 1, 1866, the elevation was found to be 417·5 feet above sea-level. A drift-mark was observed 5 feet above the surface of the water on the date of the survey, when the level was about its normal.

Loch a' Mhuilinn consists of a deep central basin, with two small subsidiary shallow basins at the two ends, as shown in the longitudinal section on the map. Towards the west end, immediately to the north of the island at the mouth of the inflowing river, a depth of 25 feet was recorded, separated from the main basin by a rise of the bottom, on which a maximum depth of 12 feet was observed. Towards the east end, between Eilean a' Mhuilinn and the mouth of the outflowing river, a depth of 24 feet was recorded, separated from the main basin by a depth of 3 feet in the narrows between the island and the northern shore. In the main deep basin the contour-lines are continuous and

the bottom regular, seven soundings in depths exceeding 80 feet having been recorded to the west and south-west of Eilean a' Mhuilinn, two of them in depths exceeding 90 feet. The area of the lake-floor covered by less than 50 feet of water is about 72 acres. The following series of temperatures taken in the deepest part of the loch shows that the body of water was nearly uniform in temperature on the date of the survey, the extreme range observed being less than 1° Fahr.:—

Surface	47°·2	Fahr.
10 feet	47°·0	„
25 „	46°·8	„
50 „	46°·6	„
90 „	46°·4	„

Loch Bunacharan (see Plate V.).—Loch Bunacharan (or Banchron) lies less than a mile to the east of Loch a' Mhuilinn and about 6 miles east of Loch Monar, and is the final one of the series of lochs in Glen Strath Farrar. The shores are mostly of gravelly *débris*, forming terraces about 20 feet high, which are best seen along the south shore; the surrounding hills are high and rugged, and well wooded. The loch trends east-north-east and west-south-west, and is $1\frac{1}{4}$ miles in length, with a maximum width of nearly one-third of a mile, the superficial area being about 157 acres, or a quarter of a square mile. The area draining directly into Loch Bunacharan is only about 4 square miles, but it receives the overflow from Lochs Calavie, an Tachdaidh, an Gead, Monar, and a' Mhuilinn, and its total drainage area is therefore a very large one—about 92 square miles. The maximum depth of 113 feet was observed towards the east end of the loch—less than half a mile from the east end and more than three-quarters of a mile from the west end. The volume of water is estimated at about 343 million cubic feet, and the mean depth at over 50 feet. The loch was surveyed on October 12, 1903, when the elevation of the lake-surface above the sea was found by levelling from bench-mark to be 366·15 feet; when levelled by the officers of the Ordnance Survey on June 9, 1866, the elevation was 366·5 feet above sea-level. On the date of the survey the water was about its normal level, and a recent drift-mark was observed 9 feet above the surface of the water, while an older drift-mark was 11 feet above the water-surface.

Loch Bunacharan is irregular in conformation, the lake-floor in the deeper part of the loch rising and falling in a series of undulations. The 25-feet and 50-feet contours are continuous from end to end of the loch, and coincide approximately with the shore-line. The 75-feet contour, however, encloses three distinct basins separated from each other by shallower water, viz. (1) a very small basin based on a sounding in 83 feet about 300 yards from the western end; (2) a larger basin a quarter of a mile in length, and trending almost north and south, *i.e.* transversely across the loch, based on soundings in 78, 82.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Affric	747·0	119	3·20	0·46	0·26	8·1	221	93·64	42·4	76	181	2,146	0·82	46·66	56·9
an Laghair	—	23	0·62	0·28	0·21	33·8	100	37·23	37·2	33	88	135	0·13	52·50	403·9
Beinn a' Mheadhoin ...	—	73	2·64	0·44	0·30	11·3	167	65·36	39·1	83	213	1,435	0·79	67·98	86·0
na Beinne Baine ...	—	75	0·97	0·40	0·25	25·8	67	28·33	42·3	76	181	190	0·24	1·48	6·2
Lungard	761·3	55	1·44	0·34	0·23	16·0	129	63·68	49·4	59	119	599	0·34	22·84	67·2
Mullardoch	—	111	4·16	0·46	0·28	6·7	197	77·52	39·4	111	283	2,553	1·18	50·37	42·7
Sealbhag	—	33	0·64	0·22	0·17	26 6	56	20·66	36·9	60	164	61	0·11	53·86	489·6
Calavie	1128·35	58	1·12	0·36	0·23	20·6	84	37·91	45·1	70	156	276	0·26	2·31	8·9
an Tachdaidh	—	38	0·62	0·37	0·23	37·1	62	17·88	28·8	53	183	72	0·14	6·60	47·1
an Gead	—	52	1·21	0·27	0·14	11·6	30	11·29	37·6	213	566	54	0·17	9·12	53·7
Monar	663·9	117	4·10	0·42	0·29	7·0	260	98·33	37·8	83	220	3,213	1·17	50·06	42·8
a' Mhuilinn	417·65	43	0·84	0·36	0·19	22·6	94	34·15	36 3	47	130	150	0·16	87·82	548·8
Bunacharan	366·15	44	1·26	0·30	0·19	15·1	113	50·11	44·3	59	133	343	0·25	91·94	367·7
		841										11,227	5·76	215·26 *	37·4

* The drainage areas of Lochs Affric and an Laghair are included in that of Loch Beinn a' Mheadhoin; those of Lochs Lungard and Mullardoch in that of Loch Sealbhag; and those of Lochs Calavie, an Tachdaidh, an Gead, Monar, and a' Mhuilinn in that of Loch Bunacharan.

and 88 feet, situated about one-third of a mile from the western end; and (3) the largest and deepest basin, one-third of a mile in length, approaching to within a quarter of a mile from the eastern end, and enclosing a small basin exceeding 100 feet in depth, based on soundings in 105, 111, and 113 feet. Between the second and third basins above noted there is a rise of the lake-floor near the middle of the loch, covered by 43 feet of water, surrounded on all sides by deeper water. These inequalities are indicated to some extent in the longitudinal section A–B on the map, taken along the axis of maximum depth, but most of the cross-lines of soundings show a regular bottom, as shown in cross-section C–D, taken at the position of the deepest sounding. The slope of the bottom seems to be gentle on the whole, the steepest gradient observed being off the northern shore towards the west end, where a sounding in 48 feet was taken about 50 feet from shore. The area of the lake-floor covered by less than 50 feet of water is about 80 acres, or 51 per cent. of the total area. The following series of temperatures, taken in the deepest part of the loch, show that the whole body of water was practically uniform in temperature:—

Surface	48°·2 Fahr.
25 feet	48°·2 „
50 „	48°·0 „
75 „	48°·0 „
90 „	48°·0 „
110 „	47°·9 „

The particulars regarding the lochs dealt with in this paper are collected together in the opposite table for convenience of reference and comparison.

From this table it will be seen that in the thirteen lochs under consideration, which cover an area of 5¾ square miles, about 850 soundings were taken, or an average of 146 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 11,230 millions of cubic feet, and the area draining into them is over 215 square miles, or thirty-seven times the area of the lochs.

GEOLOGICAL NOTES ON THE LOCHS WITHIN THE BASIN OF THE FARRAR.

By B. N. PEACH, LL.D., F.R.S., and J. HORNE, LL.D., F.R.S.

The mapping of the western part of the Beauly basin by the Geological Survey has only been carried southwards to the watershed between Glen Strath Farrar and Glen Cannich, and hence the following notes are confined to the lakes lying within the basin of the Farrar. This area is entirely occupied by the metamorphic rocks of the Highlands, which have been arranged in two divisions: (1) An older series, which has been correlated with the Lewisian or Archæan gneiss of the West Highlands; and (2) a group of crystalline schists, termed the Moine series by the

Geological Survey, which are regarded as altered sediments, and are supposed to rest unconformably on the older Lewisian gneiss.

The members of the older series comprise hornblendic and biotite gneisses, and ultrabasic masses, together with crystalline limestone, graphite schists and eclogites, which resemble the rocks of Lewisian age in the neighbourhood of Glenelg. The Moine series includes two prominent subdivisions: (1) flaggy and massive quartz-biotite-granulites; and (2) muscovite-biotite schists, the latter probably representing an argillaceous phase of sedimentation. In the basin of the Farrar the general strike of the crystalline schists, with the exception of local variations, is north-north-east and south-south-west, or north-east and south-west—that is to say, obliquely across the course of the main valley.

The basin of the Farrar is traversed by a powerful dislocation, which passes from the Conon valley in a south-west direction by Gleann Chorainn and the head of the river Orrin, thence across Loch Monar to the south-west shoulder of the Riabhachan. It forms a well-marked feature, and is accompanied by much brecciation and staining of the rocks, as may be seen along its course to the north-east of Loch Monar. At certain localities, parallel or branching faults, presumably connected with the main dislocation, are met with, which modify to some extent the surface features.

During the period of confluent glaciers, the ice radiating from the mass of high ground south of Loch Monar, embracing Sgurr na Lapaich, 3773 feet, and An Riabhachan, 3696 feet, and from the heights between that lake and Gleann Fhiodhaig to the north, flowed eastwards down Glen Strath Farrar, and streamed northwards through some of the passes towards the Orrin and Glen Fhiodhaig, and westwards in the direction of the valley of the Ling. At a later stage it escaped only by Strath Farrar. The diverging movement through the various passes is indicated partly by ice-markings, and partly by the disposition of the moraines.

Loch Monar is a true rock basin carved mainly out of the crystalline schists of the Moine series, modified by the movements accompanying the Strath Conon fault and its branches, to which reference has already been made. The lip of the basin is now about half a mile below the present outlet of the lake, the intervening area being silted up by the alluvium brought down by Allt Coire na Faochaige—a tributary which joins the main stream opposite Monar Lodge. The rocks forming the barrier of the lake are well seen in the gorge of the Garbh-uisge, where they consist of massive siliceous Moine schists, intensely plicated along vertical axes trending north-east and south-west.

In the narrow part of the lake immediately above Monar Lodge there is a small subsidiary basin, which may be accounted for by inequalities in the hardness of the rocks, and by the irregular distribution of the drift on the west side of the loch. The deep part of the main basin coincides with the belt of crushed strata accompanying the Strath Conon fault that crosses the lake near Lub-an-Inbhir and the parallel dislocation above Creag na h-Iolaire. A third fault, trending east and west, enters the loch at the mouth of Allt nan Uan, which has produced considerable brecciation of the rocks.

The shallow bar near the head of the loch is due to a spit of sand, brought down partly by Allt Riabhachan and partly by the stream at Pait, which has been distributed by the action of the waves. The long stretch of alluvium along Amhainn-an t-Sratha Mhòir indicates that the lake has been silted up for about a mile above its present western limit.

Loch an Tachdaidh and An Gead Loch.—These lochs lie in the bottom of the valley drained by the Garbh-uisge at Pait, which flows into Loch Monar, and are entirely surrounded by drift deposits of the later glaciation. All the small

projections into these lakes are due to moraine heaps, arranged in such a way as to suggest that they are probably the terminal moraines of a lobe of ice that moved westwards towards the basin of the river Ling.

Loch Calavie lies in one of the passes through which the ice escaped westwards from the Monar area during the period of confluent glaciers. Though immediately surrounded by moraines and peat, it is evidently in part a rock basin, as the rocky barrier formed of muscovite-biotite gneiss appears in the stream not far below the outlet of the lake. The deepest sounding is 84 feet.

Loch Bunacharan and Loch a' Mhuilinn.—These lakes are situated in the valley of the Farrar about midway between Loch Monar and Struy. Their long axes seem to coincide generally with the strike of the crystalline schists. In the case of the former lake, its height above sea-level is 366 feet, its greatest depth 113 feet, and the position of the rocky barrier exposed in the stream about one-third of a mile below the outlet is about 360 feet. The surface level of Loch a' Mhuilinn is 417 feet, and the deepest sounding is 94 feet, and as it discharges over solid rock, it is evidently a small rock basin. There is a high terrace round Loch a' Mhuilinn and on the south side of Loch Bunacharan at a level of 440 feet.

NOTES ON THE BIOLOGY OF THE LOCHS OF THE BEAULY BASIN.

By JAMES MURRAY.

The lochs of Beauly valley were surveyed in late autumn, during very severe weather, unfavourable for the study of biology. The lochs in Glen Affric were visited in a time of heavy floods, which raised the lochs several feet while we were working at them. Though the tow-nets were used, there was almost nothing got in them. The lochs appeared to be flushed and washed out by the spate, or else the animals had gone down to quieter water.

Throughout the rest of the basin there was great uniformity, the ordinary universal limnetic Crustacea and Rotifers alone being present, with little call for remark. There was an entire absence of all the northern species of *Diaptomus*, and, although Desmids were fairly abundant in most of the lochs, there were none of the western species.

The few species which only occurred in some of the lochs are noted below. These are also generally distributed in summer, their scarcity in these lochs being due to the late season at which they were visited.

Daphnia.—In all the lochs where *Daphnia* occurred, it was as the variety *galeata*, a large form with the head angled.

Holopedium gibberum.—Only in Lochs Calavie and an Tachdaidh.

Leptodora kindtii.—Only in Loch Monar.

Polyphemus pediculus.—An Gead loch.

Cyclops strenuus.—Present in most of the lochs. The *Cyclops* in Loch Calavie were red-spotted.

Diaphanosoma brachyurum.—Found in four lochs—Tachdaidh, Bunacharan, Mullardoch, and Lungard.

Floscularia pelagica.—Loch Monar.

Conochilus.—Both species, *C. unicornis* (the common lake species) and *C. volvox*, were present in Loch Monar.

Sponge.—A fresh-water sponge, species not determined, came up attached to the sounding-rod, from depths of 6 or 8 feet, in Loch a' Mhuilinn. The pieces were long, finger-shaped.

THE NOMENCLATURE OF THE NORTH AMERICAN CORDILLERA BETWEEN THE 47TH AND 53RD PARALLELS OF LATITUDE.*

By REGINALD A. DALY, Ottawa, Canada.

Introduction and Outline.—In point of area, if not as certainly in point of total volume above sea, the western mountains of North America constitute by far the greatest system of the Earth. This vast region has always been very sparsely inhabited. In the orographic features it is generally complicated, often to the uttermost. Its exploration is only well begun. There are thus excellent reasons why the mountain units of this region are so inadequately named and systematized in geographical works, whether issued as official Government reports, as educational text-books or atlases, or as popular records of travel. Yet, whether he will or no, the explorer responsible for a report on any part of this region must confront the question of names. He returns from his rugged field, and, to tell of his findings, must use common nouns to indicate what kinds of land-relief he has found, and proper names to aid in individualizing and locating those reliefs in the huge backbone of the continent.

This duty has fallen to the writer in the task of reporting on the geology of the mountains crossed by the 49th parallel boundary between Canada and the United States. Though the same transmontane section has been described by the geologists attached to the 1857–61 commission, though it occurs along the most thickly settled part of British Columbia, and though it is nowhere very far from the lines of two transcontinental railroads, a complete and systematic grouping of the mountains on the boundary has never been made. The difficulty of supplying the lack was felt by the writer in the first of the five seasons devoted to the geology of the boundary, but the difficulty was more fully realized as the dire confusion of the nomenclature already in vogue became apparent.

It is manifest that any attempt to develop a constructive view of the boundary mountains should be founded as far as possible upon established units already understood and named. The literature has, therefore, been carefully searched to furnish this required foundation. The result has shown a truly surprising variety of usages in names and in concepts of the topography. The course of compilation inevitably led to the study of the nomenclature of western ranges even far away from the 49th parallel of latitude. Examples of the differences of usage are recorded in the first part of the following paper. The record may serve in some degree to illustrate the need of a

* Published by permission of the Canadian Commissioner, International Boundary Surveys.

consistent scheme of nomenclature, possibly to suggest partial grounds on which uniformity may some day be established.

The second part of this paper is concerned with a brief account of the nomenclature that seems most appropriate for the ranges crossed by the international boundary.

Different Nomenclatures in Use.—The search for the variations of nomenclature was made both among authorities responsible on the ground of priority and among authorities influential as standard compilers from original sources. For the present purpose of indicating the lack of uniformity and the confusion into which the great mass of the people may be led by consulting existing works of reference, it is not sufficient to record names found only in Government map or careful scientific monograph. Perhaps more important still in this connection is the record to be made from standard atlases, from school geographies, and from standard influential guide-books. In reality, it has required the examination of but a very limited number of each kind of authoritative works to point the moral. With few exceptions the only works consulted were printed in the English language.

The Diverse Naming of the Western Mountain Region as a Whole.—The question of the best general title for the western mountains may be considered as trite by those who do not feel the immediate need of its solution in their professional work. The writer by no means believes it to be trite, as he now completely realizes the wide latitude in naming among the recent influential publications dealing with North American geography. It is scarcely to the credit of our geographical societies and alpine clubs that they will publish at length the statement of one traveller that he found mosquitoes in Newfoundland, of another that his hotel accommodation in Manila was bad, and leave undiscussed the suggestive paper of Prof. Russell and his correspondents on the names of the larger geographical features of North America.* There would be no advantage to the European geographers if the Alps masqueraded under a dozen different general titles dependent on the personal tastes of individual writers on those mountains.

It is well known that one of the first designations of the entire mountain group lying between the Pacific and the Great Plains was due to Humboldt. His "Cordilleras of the Andes" extended from Cape Horn to the mouth of the Mackenzie river. Humboldt occasionally used the singular form "Cordillera of the Andes" for the same concept. In view of the general restriction of the term "Andes" to the mountains of South America, Whitney, in 1868, proposed that the name "Cordilleras," with variants, "Cordilleran System" and "Cordilleran Region," be retained to designate the North American equivalent of the Andes.

* *Bull. Geog. Society of Philadelphia*, 1899, vol. 2, p. 55.

Map to illustrate the paper on
the Nomenclature of a part of the

NORTH AMERICAN CORDILLERA

By REGINALD A. DALY.

This name was adopted in the United States census reports for 1870 and 1880, and by a great number of expert geologists and geographers since 1868. In process of time, however, the singular form, "Cordillera" and variants, became used in the same sense. In one of these forms the Humboldt root word with Whitney's definition has entered many atlases. It appears on numberless pages of high-class Government reports, geographical, geological, and natural history memoirs, and of such works as Baedeker's 'Guide-book to the United States,' Stanford's 'Compendium of Geography,' etc.

The time-honoured, erroneous, similarly inclusive name "Rocky Mountains," with variants, "Rocky Mountain System," "Rocky Mountain Belt," etc., has, however, held the dominant place in the popular usage. Its inappropriateness for the heavily wooded Canadian mountains is abundantly evident. For the United States, Clarence King wrote a generation ago—

"The greatest looseness prevails in regard to the nomenclature of all the general divisions of the western mountains. For the very system itself there is as yet only a partial acceptance of that general name Cordilleras, which Humboldt applied to the whole series of chains that border the Pacific front of the two Americas. In current literature, geology being no exception, there is an unfortunate tendency to apply the name Rocky mountains to the system at large. So loose and meaningless a name is bad enough when restricted to its legitimate region, the eastern bordering chain of the system, but when spread westward over the Great Basin and the Sierra Nevada, it is simply abominable." *

The following table summarizes the above-mentioned variants along with others more recently introduced, and still other general names now only of historical interest. The names of prominent authorities and the leading dates when they have published the respective titles are also entered in the table. The authority for some of the older names is Whitney's work on the United States, published in Boston, 1889.

Mountains of the Bright Stones	General use, end of eighteenth century.
Shining Mountains	Morse, 'Universal Geography,' 1802.
Stoney or Stony Mountains	Arrowsmith, 1795; President Jefferson.
Columbians (*sic*) Mountains	Tardieu, 1820.
Chippewayan Mountains	Hinton, 1834.
The Cordilleras of the Andes (in part)	Humboldt, 1808, etc.
The Cordillera of the Andes (in part)	Humboldt, 1808, etc.

* 'U.S. Geol. Exploration, 40th Parallel, Systematic Geology, 1878,' p. 5.

The Cordilleras	Whitney, 1868; many authors since.
The Cordillera	G. M. Dawson, 1884, etc.; Gannett, 1898; Rand-McNally, 1905.
The Western Cordillera of North America	J. D. Dana, 1874, 1880.
The Cordilleras of North America	Hayden, 1883; Leconte, 1892, etc.
The Cordilleran Region	Whitney, 1868, etc.; Hayden, 1883; Shaler, 1891.
The Cordilleran System	Whitney, 1868, etc.; King, 1878; Baedeker, 1893.
The Cordillera System	Hayden, 1883.
The Cordillera Belt	G. M. Dawson, 1879, etc.; Rand-McNally, 1902.
The Pacific Cordillera	Russell, 1899, 1904.
The Cordilleran Plateau	Hayden, 1883.
The Cordillera of the Rocky Mountains	J. D. Dana, 1895.
The Rocky Mountain System	Leconte, 1892, etc.; Heilprin, 1899; many others.
The Rocky Mountain Region	Powell, 1875, etc.; G. M. Dawson, 1890; Gannett, 1899.
The Rocky Mountain Belt	Rand-McNally, 1902.
The Rocky Mountains	Lewis and Clarke; popular.
The Pacific Mountains	Russell, 1899, 1904; Powell, 1899.
The Western Highland	Baedeker, 1893; Keith Johnston Atlas, 1896; Davis, 1899.
The Rocky Mountain Highland	Frye, 1895, 1904.
The Western Plateau	English Imperial Atlas, 1892.

In most technical writings, both of governmental and of private origin, the suggestion of Whitney has been followed with varying fidelity during the last thirty-five years. It is clear that the inherent connotation of "Cordilleras" is different from that of "Cordillera." The one emphasizes the compound nature of the orographic unit; the other, the singular form of the word, emphasizes the organic union of members. Hayden used both forms of the word. In recent years there has been a rather widespread adoption of the term in the singular number. In 1874, J. D. Dana proposed that the great mountain systems of North America be referred to as the "Western Cordillera" and the "Eastern Cordillera," the latter thus synonymous with what is now commonly called the Appalachian system. Russell, in 1899, proposed

"Pacific Cordillera" and "Atlantic Cordillera" with respectively the same significance. Usage has, however, declared that there is but one Cordillera in North America. The expression "Pacific Cordillera" is, according to such established usage, redundant. "The Cordillera of North America," "The Cordilleran System," "The Cordilleran Region," or, with the proper context, simply "The Cordillera," seem to be to-day the best variants on the Humboldt root-word.

The fine, dignified quality of the word, convenient in adjective form as in noun form, its unequivocal meaning and its really widespread use in atlas and monograph make "Cordillera" incomparably the best term for technical and even for the more serious popular works. In fact, there seems to be no good reason why the name should not be entered in elementary school atlases. The objection that the word is likely to be mispronounced by teacher or scholar would equally exclude "Himalaya" and "Appalachian" from school-books. In teaching or learning what is meant by "the Cordillera," the teacher or scholar would incidentally learn so much Spanish. If, in the future, this should be deemed an intolerable nuisance, speakers in English could, in their licensed way, throw the accent back to the second syllable and avoid the unscholarly danger. The second objection that a cordillera is hereby made to include the extensive plateaus of Utah and Arizona or the great intermontane basins of the United States is more serious. It will, however, hardly displace the word from its present technical use as designating a single Earth-feature ruggedly mountainous as a whole, but bearing subordinate local details of form and structure not truly mountainous. If this objection be regarded as invalid by advanced scientific workers, it will have still less weight for popular or educational use.

The ordinary connotation of the term "highland" makes it unsuitable as part of the name indicating the world's vastest mountain group. Like Powell's name "Stony Mountains," suggested for the majestic Front ranges north of the Union Pacific Railroad, "highland" is "belittling." To most readers it would inevitably suggest Scotland's relief. If the word be raised to the dignity proposed in "Western Highland" or "Rocky Mountain Highland," the writer on the natural features of the Cordillera runs the risk of ambiguity in employing the indispensable common noun "highland," while dealing with local problems of geology, geography, or natural history.

For popular use, the best title alternative with "Cordillera" is, in the writer's opinion, "The Pacific Mountain System." It is suggested by Russell's "The Pacific Mountains." The addition of the word "system" seems advisable as stating the unity of the whole group. The proposal of J. D. Dana to restrict the common noun "system" to mean merely the group of ranges formed in a single geosyncline has to face overwhelming objections. The usage of generations is against it;

the enormous difficulty of actually applying it in nature is, perhaps, yet more surely fatal to the idea.

The restriction of the titles "Pacific Ranges" (Hayden), "Pacific Mountains" (Powell in his earlier use of that term; he has since applied it to the whole Cordillera), and "Pacific Mountain System" (A. C. Spencer and A. H. Brooks) to the relatively narrow mountain belt lying between the ocean and the so-called "Interior Plateau" of the Cordillera, seems particularly unfortunate. If there is one grand generalization possible about the entire Cordillera, it is that the Cordillera is, both genetically and geographically, a Pacific feature of the globe. The Rocky Mountain ranges proper, the Selkirks, and the Bitter Roots bear the marks of interaction of Pacific basin and continental plateau as plainly as do the Sierra Nevada, the Coast ranges, or the St. Elias range. The large view of the Cordillera assuredly claims the word "Pacific" for its own, and cannot allow in logic that "Pacific Mountain System" shall mean anything less than the entire group of mountains. The artificial nature of the narrower definition would be equally manifest if it were applied to a topographic or genetic unit forming a relatively small part of the Andes along the immediate shore-line of South America. The Andes mountains form the Pacific mountain system of South America as the whole North American Cordillera forms the true Pacific mountain system of North America.

Yet the term "system" is itself so elastic that it is fitly applied to subdivisions of the Cordillera. For example, the "Rocky Mountain System" expresses an unusually convenient grouping of the northern ranges in Alaska, and of the eastern ranges of the Cordillera in Canada and the United States. Popular, as well as scientific, usage has once for all recognized the propriety of there being in name, as well as in fact, system within system in the grouping of mountains.

The Diverse Naming of Ranges crossed by the 49th Parallel (the International Boundary).—There is a double difficulty in describing the mountains along the international boundary. The same range may bear different names with different authorities, or may be differently delimited by different authorities. Some examples chosen from recent atlases and texts will illustrate this point.

1. *Cascade range* (also called Cascade chain or Cascade mountain chain), according to different authorities—

(*a*) Extends from Mount Shasta into the Yukon territory;

(*b*) Extends from Mount Shasta to the British Columbia boundary;

(*c*) Extends from Mount Shasta to the Fraser river, and east of it to the Thompson river;

(*d*) Forms the extreme northern part of the British Columbia Coast range north of Lynn canal, the real Cascades being mapped as the "Coast Range" (Johnson's 'Cyclopædia').

2. *Coast range* of British Columbia, also called the "Alpes de Colombie" (Atlas Vidal-Lablache) and "See Alpen" (Stieler's Handatlas, which continues the "Cascaden Kette" across the Fraser river). See also usages under "Cascade Range."

3. *Selkirk mountains*, according to different authorities—

(*a*) Lie west of Kootenay lake, entirely in Canada, or extending into the United States;

(*b*) Lie west of Kootenay lake, and either entirely in Canada or extending into the United States;

(*c*) Extend on both sides of Kootenay lake, but entirely in Canada.

(*d*) Do not extend south of the northern extremity of Kootenay lake;

(*e*) Contrary to all of the above-mentioned usages, extend across the Columbia river north-westward to Quesnel lake in 53° N. lat. (Brownlee's Map, 1893).

4. *Purcell range*, according to different authorities—

(*a*) A local rangelet in the West Kootenay district, British Columbia;

(*b*) Includes all the mountains between Kootenay lake and the Rocky Mountains proper, entirely in Canada;

(*c*) Includes the same mountains as under (*b*), but extends into the United States as far as the great loop of the Kootenay river.

5. *Bitter Root mountains* (also spelled "Bitterroot") used—

(*a*) In the larger sense of most maps; or

(*b*) In a much narrower sense, a small range overlooking the Bitter Root river (Lindgren).

6. *Rocky Mountains or Rocky Mountain system*, also called the Front range, and Laramide range; often alternative for "Cordillera."

7. *Gold range* of British Columbia, a name applied to a local range crossed by the main line of the Canadian Pacific Railway, and west of the Columbia river; also applied to a much greater group, including the Selkirk, Purcell, Columbia, Cariboo, and Omineca ranges (Gold ranges, an alternative form of the title in this latter meaning).

The confusion of the nomenclature is aggravated in the case of certain atlases, which in different map-sheets give different titles to the same range. Thus, on one map of the new Rand-McNally 'Indexed Atlas of the World,' the western mainland member of the Cordillera in British Columbia is correctly named the Coast range, on another sheet incorrectly named the Cascade range. The same indefensible carelessness even appears in certain Canadian school atlases. In the Rand-McNally map of British Columbia, the Selkirks are represented as ending on the south at the head of Kootenay lake, and are continued to the eastward of that lake by the "Dog Tooth Mountains," the latter

name absolutely unfamiliar to the people of British Columbia. In the general map of the United States published in the same atlas, the Selkirks are represented as quite defined to the westward of Kootenay lake. The area thus inconsistently mapped has a width equal to the average width of the Alps.

The Adopted Nomenclature of the Boundary Mountains.—On the line of the 49th parallel of latitude, the Cordillera has already assumed what may be called its British Columbia habit as contrasted with its 40th parallel habit. The division of the whole into orographic units is relatively simple in Colorado, Utah, Nevada, and California, where the building and erosion of the Cordillera have resulted in a comparatively clear-cut separation of the component ranges by broad intermontane plains of mountain waste or of lava filling vast structural troughs or basins. Nothing quite comparable is to be seen anywhere in the Canadian portion of the Cordillera. Near the latitude of Spokane, the whole mighty group of ranges is marshalled into a solid phalanx of closely set mountains which sweep on in substantial unity north-westward through Yukon territory into Alaska. The area of British Columbia alone would enclose twenty-four Switzerlands. For purposes of exposition this mountain sea must be divided and subdivided. How shall it be done?

The remarkable insight and generalizing power of the pioneer in British Columbia geology, G. M. Dawson, early supplied what seems to be the only fruitful principles. His classification applies chiefly to Southern British Columbia, but it is probable that its principles must be extended throughout the Canadian Cordillera. In 1879 Dawson announced the possibility of a natural division of the mountains between the 49th and 55th parallels into three broad belts paralleling the coast.

The middle belt, the "Interior Plateau," afterwards described in some detail, has the special style of topography characteristic of closely folded mountains once reduced by denudation to mere rolling hills or an imperfect plain since uplifted and cut to pieces by streams. In other words, the Interior Plateau is, by Dawson's definition, an uplifted, dissected peneplain, a region of plateaus and hills remnant from the old surface of denudation. Yet Dawson himself concluded that, while many of these tabular reliefs may be correlated into the ancient facet of denudation, other similar reliefs in the belt are structural, and due, namely, to the erosion of wide flat-lying lava-flows that flooded the country after the peneplanation. Another and simpler explanation of the topography makes the lava flooding anterior to peneplanation. Still, a third history may, on further investigation, turn out to be the true one. At the present time it is impossible to decide between the rival views.

A safer definition of the region is purely topographic; it may thus

be called the Belt of Interior Plateaus, or, briefly, the Interior Plateaus. This slight change in Dawson's name lays stress upon the individual tabular reliefs so characteristic of the region. These reliefs are *facts;* the peneplain and the involved assumption that the myriad individual reliefs belong to a physiographic unit, a single uplifted peneplain, are matters of theory. The pluralizing of the word "plateau" in the title not only changes the emphasis, but, in so doing, restores the term to its more advisable definition of a tabular relief bounded by strong downward slopes. The Interior Plateau as defined by Dawson is bounded on all sides by the strong upward slopes of the enveloping mountain ranges.

The belt of the Interior Plateaus having thus been differentiated on special grounds, we may pass to the subdivision of the remaining two parts of the British Columbia complex. Those two belts separated by the plateau belt are rugged, often alpine, and, as a rule, do not show tabular reliefs. Present knowledge of the vast field cannot provide a rational treatment of these mountains rigidly on the basis of either rock-composition or structural axes or geological history. It is possible, if not indeed probable, that the ranges immediately bounding the belt of Interior Plateaus have had a common history with it; they certainly include the same rock-formations as occur in the interior plateaus. If the peneplain theory be finally accepted for the latter, it may ultimately prove best to treat the Coast range and other ranges in terms of the same theory. The only feasible scheme of subdivision at the present day must be based on topography only.

Mere hypsometry will not serve alone; the ranges of summit altitudes is too slight, their variation too unsystematic, for that. Dawson found that continuity of crest-lines and the position of the greater erosion valleys formed the most available basis of classification. As field work progresses in British Columbia, it becomes more and more certain that this double principle is the best that could be devised for present use. Many of the larger valleys are undoubtedly located on structural breaks, but it is yet more evident that the strength of most of the valleys is the more direct result of fluviatile and glacial erosion. Owing to the peculiarly complicated rearrangements in the drainage of the Cordillera, whether due to glacial, volcanic, or crustal disturbances, or to spontaneous river adjustments, the valleys of British Columbia are in size very often quite out of relation to their respective streams. For example, the longest depression in the whole Cordillera is occupies. by relatively small streams, the headwaters of the Kootenay, Columbia, Fraser, etc. Each of the rivers named, in its powerful lower course, flows through narrow canyons. Erosion-troughs rather than rivers have, therefore, been selected by Dawson and other explorers as the natural lines of demarcation between most of the constituent ranges of the Cordillera in these latitudes. The procedure is not new, but it is

noteworthy as the most wholesale application of the principle on record. It stands in contrast to the more structural treatment, not only possible, but enforced by the orographic conditions in the United States.

In the course of his own work, the writer has become convinced of the permanent value of Dawson's early and consistently held general view of the British Columbia mountains. But there has arisen the necessity of extending it to cover the boundary mountains which, for the most part unvisited, were left unnamed by Dawson. The task of systematizing them is simple only in the stretch from the Great Plains to the Kootenay river at Tobacco Plains, a width of about 75 miles. The remainder, or five-sixths, of the Cordillera on the international line is either not grouped into organic units at all, or, where so grouped, the names of the groups are not universally accepted. In attempting to supply this lack of system, the writer's aim has been to avoid, as far as possible, the introduction of new names. In fact, it seems best to develop a system of grouping and nomenclature largely founded on names and concepts already in use, but not generally applied to the mountains so far south as the boundary.

A point of departure is readily found. Within the Cordillera on the 49th parallel, there are eleven principal longitudinal valleys which serve as convenient lateral boundaries for the members of the system. Of these, four belong to the first rank. The wide valley occupied at the boundary by the Kootenay river is the easternmost and much the longest. It is a part of a single Cordilleran feature easily the most useful in delimiting the Canadian ranges. From Flathead lake to the Liard river, a distance of about 800 miles, this feature has the form of a narrow, wonderfully straight depression lying between the Rocky Mountain system and all the rest of the Cordillera. Unique among all the mountains of the globe for its remarkable persistence, this depression is in turn occupied by the headwaters of the Flathead, Kootenay, Columbia, Canoe, Fraser, Parsnip, Finlay, and Kachika rivers, and is therefore not fairly to be called a valley. It may for present purposes be referred to as the "Rocky Mountain Trench." The term "trench" throughout this paper means a long, narrow, intermontane depression occupied by two or more streams (whether expanded into lakes or not) alternately draining the depression in opposite directions.

The first-rank valley next in order on the west is also occupied at the boundary by the Kootenay river, returning into Canada from its great bend at Jennings, Montana. This valley begins on the south near Bonner's Ferry, Idaho, and is continued north of Kootenay lake by the valley of the Duncan river. Recently A. O. Wheeler has shown that the singular 50-mile trough occupied by Beaver river, which enters the Columbia river at the Canadian Pacific railway, is precisely *en axe* with the Duncan river valley. The whole string of valleys from Bonner's

Ferry to the mouth of the Beaver, a distance of approximately 200 miles, forms a topographic unit that may be called the "Purcell Trench."

The third of the first-rank valleys is drained southward by the Columbia river, expanded upstream to form the long Arrow lakes. At its northern extremity near the 52nd parallel of latitude, this valley is confluent with the Rocky Mountain trench. The southern termination of the valley regarded as a primary limit for these mountain ranges occurs about 60 miles south of the 49th parallel, where the Columbia enters the vast lava plain of Washington. To distinguish this orographic part of the whole Columbia valley between the points just defined, it may be called the "Selkirk Valley."

A glance at the map will show that the two primary trenches and the Selkirk valley are in simple mnemonic relation to three principal mountain divisions of the Cordillera. They lie respectively to the westward of the Rocky Mountain system, the Purcell range, and the Selkirk system.

The fourth of the first-rank valleys carries the south-flowing Okanagan river, with its various upstream expansions, including Osoyoos and Okanagan lakes. The latter lies wholly within the belt of Interior Plateaus, a primary Cordilleran division. Important as Okanagan lake is, no one has yet suggested that the plateau belt itself be subdivided into named portions separated by the lake. It appears, on the other hand, wiser to recognize in the nomenclature the essential unity of the belt. The southern portion of the Okanagan valley stretching from the mouth of the Similkameen river to the confluence with the Columbia, has, however, a decided function in separating the Cascade range from the very different mountains east of the Okanagan river. This portion may be called the lower Okanagan valley.

The seven second-rank longitudinal valleys have unequal authority in delimiting constituent ranges. The valley of Waterton river and lake, with the parallel valleys of the Flathead and Wigwam rivers, are well known to divide the Rocky Mountain system at the boundary respectively into the Lewis, Livingstone, MacDonald, and Galton ranges. Similarly, the valleys of the Skagit and Pasayten rivers subdivide the Cascades into the Skagit range, the Hozomeen range, and the Okanagan range. The Kettle river valley of British Columbia, in part, and the Pend D'Oreille valley of Washington, in part, are likewise subordinate longitudinal depressions which merit attention, although they have never hitherto been used in delimiting ranges.

Transverse valleys may also be employed if this method of orographic treatment is applied to the fullest practical extent. These will be referred to in connection with certain of the ranges now to be described as primarily bounded by the longitudinal valleys and trenches. Finally, the Great Plains, the lava plain of Washington and Idaho, the straits of

Georgia and Juan de Fuca, form other and obvious boundaries to some of the subdivisions.

As already suggested, the Rocky Mountain system has an extraordinarily definite limit on the west—the Rocky Mountain trench. The eastern escarpment, broken as it is in detail, is also notably straight and continuous along the 1000-mile front from Montana to Yukon territory.

Westward from Tobacco Plains, on the 49th parallel, we cross, in the air-line, 60 miles of ridges belonging to a range unit which is almost as systematic as the great group on the east. The crests of this second group are in unbroken continuity from the wide southern loop of the Kootenay river at Jennings to the angle where the Purcell trench is confluent with the Rocky Mountain trench. Throughout this area the drainage is quite evenly divided by the easterly and westerly facing slopes of the unit-relief. This strong and extensive range has, in its northern part, been generally regarded as part of the Selkirk mountain group. The middle and southern part, though broader and including most of the area, has, as a whole, never been authoritatively placed in the Selkirk system. Palliser gave the name "Purcell Range" to a single component of the unit, namely, the group of summits lying between Findlay creek and St. Mary river. Dawson extended the name to cover all the mountains between Kootenay lake and the Rocky Mountain trench, these mountains forming the "Purcell division of the Selkirk system;" but he did not fix either a northern or a southern limit to the group so named.

The same usage appears in the maps and texts of most geographers publishing during the last twenty-five years. It was officially adopted by the Canadian Geological Survey, and appears in the general geological map of the Dominion edited by Selwyn and Dawson, and issued by the survey in 1884. The name was accordingly entered in most of the American and European atlases of the world. For some unknown reason, the second edition of the official geological map of the Dominion (1901) represents the Purcells as constituting merely Palliser's original small group of summits, and this tradition has been followed in the new general map of the Dominion issued by the Canadian Department of the Interior (1902). Both official and general previous usages conflict with this quite recent official return to Palliser's mapping. In reality, the Palliser usage is not familiar to the people of British Columbia; it is subject to the criticism that the rangelet mapped by Palliser is not defined on the west by natural limits. The lack of definition in Palliser's exploratory sketch-mapping is such that it may even be doubted that Dawson really broke the law of priority in giving "Purcell Range" its broader meaning. The name is practically useless if it be not so extended. The long-established tradition of the influential atlases following the lead of Dawson makes it expedient to use the title in the broader meaning.

The question remains as to the northern and southern limits of the Purcell range. As a result of compiling all the available information, the writer has concluded that the range has no natural boundary to the northward, short of the confluence of the Purcell and Rocky Mountain trenches. The conclusion has been strikingly corroborated by the detailed studies of Wheeler along Beaver river. There is, similarly, no natural boundary on the south, short of the great bend of the Kootenay river in Montana. However vaguely supported by definite knowledge of the field, the latter conclusion has been anticipated by the editors of the 'Century Dictionary Atlas' (map of Montana), of the 'Encyclopædia Americana' (maps of British Columbia, Montana, and Canada), of Bartholomew's 'English Imperial Atlas,' of Keith Johnston's 'Royal Atlas,' and of Stieler's 'Handatlas.' Maps occurring in all of these works represent the Purcell range as continuing southward into the United States as far as the Kootenay river. So far as known to the writer, there is no popular or official designation for the mountains lying between that river and the Canadian boundary. The Cabinet mountains lie entirely south of the Kootenay river.

In summary, then, the great range unit here called the Purcell range is bounded by the Rocky Mountain trench, the Purcell trench, and the portion of the Kootenay valley stretching from Jennings, Montana, to Bonner's Ferry, Idaho.

The Selkirk mountain system next on the west likewise forms a range unit considerably longer than the area generally ascribed to the Selkirk group. On grounds similar to those adopted for the Purcell range, the Selkirk system may be defined as bounded on the east by the Purcell trench; on the north and north-east by a portion of the Rocky Mountain trench; on the west by the Selkirk valley; on the south by the Columbia lava plain, Pend D'Oreille lake, and a short unnamed trench extending from that lake to the Purcell trench at Bonner's Ferry. For a short stretch the Selkirk system is apparently confluent with the Cœur D'Alene mountains, though a short trench followed by the Great Northern railway may separate them. This extension of the Selkirks across the boundary has already been indicated on maps of the 'Encyclopædia Americana,' Stieler's 'Handatlas,' and the Vidal-Lablache atlas. That part of the Selkirk system lying southwest of the deep valley of the Pend D'Oreille river may be called the group of the Pend D'Oreille mountains. The well-known Slocan mountains are also separated off definitely by the Slocan trench, which is a longitudinal depression occupied by Slocan river, Slocan lake, and the creek valley mouthing at Nakusp, on Arrow lake.

The whole mountain complex embracing the Purcell range and Selkirk system, as just defined, may be viewed in another way. The Purcell range is thereby considered as part of the Selkirk system, and that division of the whole lying to the westward of the Purcell trench,

might be called the Selkirk range. The Selkirk system would thus include the Selkirk range and the Purcell range. As already noted, Dawson seems to have adopted this alternative view. An objection to it is the chance for confusion in using "Selkirk" to mean now a component range, now the inclusive system. In favour of Dawson's view is the fact that in rock composition, structural axes, and geological history, the mountains lying between the Rocky Mountain trench and the Selkirk valley form part of a natural unit. On the other hand, the Selkirk range is, structurally and lithologically, as closely allied to the Columbia system as to the Purcell range; the Purcell range is, lithologically and historically, as closely allied to the Rocky Mountain system as to the Selkirk range. The practicable orographic classification, being based upon erosion troughs, recognizes the dominant importance of the Purcell trench. That superb feature of the Cordillera cleaves the mountains in so thoroughgoing a manner that a logical grouping must regard the Purcell range as a member co-ordinate with the Selkirk range.

In the map the latter division is called the Selkirk system, because in the diagram it expressly includes the Slocan and Pend D'Oreille mountains. If, for purposes of exposition, this comprehensive character is not fixed for emphasis, the same Cordilleran member may be called the "Selkirk Range." Similarly, when the Purcell range is, in the future, subdivided into its orographic units, it may bear the name "Purcell System." "Cascade Range" and "Cascade System," "Coast Range" and "Coast System," for example, may be profitably employed with the same distinctions. In all these cases it is a matter of emphasis.

The value of this distinction in common nouns, the great orographic significance of the Purcell trench, and the weight of much authority in previous usages have caused the writer to suggest that the whole Purcell range be considered as co-ordinate with, and not part of, the Selkirk system.

The principal range unit adjoining the Selkirk system on the west is here called the Columbia system. It is definitely limited on the east by the Selkirk valley and by a part of the Rocky Mountain trench, the latter truncating the northern end of the Columbia system as it does the Selkirk and Purcell groups. On the south the Columbia system is limited by the Columbia lava plain. On the west the limit is determined by the lower Okanagan valley, and, to the northward, less well by the eastern edge of the belt of Interior Plateaus. That edge may be located for about 30 miles in the line of the main Kettle river valley. North of the main line of the Canadian Pacific railway, the belt of Interior Plateaus seems to reach, but not cross, Adams lake and Adams river. Still farther north, the western limit of the Columbia system is fixed by a trench occupied by the headwaters of the North Thompson river, and by an affluent of the Canoe river. North-west of this trench begins the great system including the Cariboo mountains.

Apparently the first official (Governmental) name for the mountains explored on the Canadian Pacific railway line west of the Columbia river was "Gold Range."* The group so named extends from the latitude of Shuswap lake to the narrows between the Arrow lakes. This usage has been adhered to by the Government of British Columbia.† In 1874, the Dominion Department of Railways and Canals introduced the name "Columbia Range" for the much larger mountain group including the "Gold Range," and extending from the headwaters of the north Thompson river southward to lower Arrow lake.‡ This usage was confirmed by Selwyn and Dawson, each in turn director of the Geological Survey of Canada.§ Nevertheless, the new general map of Canada issued by the Department of the Interior at Ottawa (1902) gives the name "Gold Range" to this larger group. The extension of the limits of the Gold range is a departure from the official tradition of both the provincial and Dominion governments. It appears best to hold the name "Gold Range" to its original designation of a local mountain group, and retain the title "Columbia Range" with a broader meaning.

For the immense Cordilleran unit stretching from end to end of the Selkirk valley, and bounded on the east by the Columbia river, there is no question that the name "Columbia Range" is more significant and appropriate than the name "Gold Range." The latter name has a special disadvantage worthy of note. Although Dawson, in his later writings, used the name "Gold Range" in its original sense of a local mountain group, he as often uses "Gold Range" or "Gold Ranges" to include the Selkirk, Purcell, "Columbia" (!), Cariboo, and Omineca ranges. This inconsistent usage robs the title "Gold Range" of even that modicum of value which it has as an alternative for the more significant title. As already stated, the name "Columbia Range," with its comprehensive meaning, has, moreover, the priority.

The extension of the apposite title, "Columbia Range" (with variant "Columbia System"), to cover the larger area described in the foregoing paragraphs is, it is true, not according to tradition, but, as in the case of the Selkirk system and Purcell range, the widening of the meaning is justified by the lack of definition as to the true areal extent of the "Columbia Range" in its original use, and is enforced by the fact of crest continuity within a fairly well delimited belt of the Cordillera.

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* Map of British Columbia, compiled under the direction of the Hon. J. W. Trutch, Chief Commissioner of Lands and Works and Surveyor-General. Victoria, 1871.

† Map of the province of British Columbia, compiled by J. H. Brownlee by direction of the Chief Commissioner of Lands and Works. Victoria, 1893.

‡ S. Fleming, Exploratory Survey, Canadian Pacific Railway report, Ottawa, 1874. Map-sheet No. 8.

§ Forest Map of British Columbia, published by G. M. Dawson in Report of Progress, Geol. Surv. of Canada, 1879–80.

The southern third of the Columbia system is characterized by comparatively low mountains, which, in rock-composition, are allied both to the northern part of the range and to the belt of Interior Plateaus. These southern mountains commonly show uniformity in summit levels. Yet there are not remnant plateaus, and it is advisable to recognize in these mountains a group distinct from the Interior Plateaus. A convenient name for the unit, "Colville Mountains," was given as early as 1859–60 by the members of the Palliser Expedition. The northern limit of this division of the Columbia system cannot, for lack of cartographic data, be fixed, but it doubtless occurs near the headwaters of the Kettle river. The north fork and main trunk of that river form the eastern boundary of the Colville group. Otherwise, the group comprises the whole of the Columbia system south of the international boundary.

A second important, though small, natural subdivision of the system is limited on the north, east, and south by the Selkirk valley; on the west, by the lower Kettle valley, and by a short trench running from lower Arrow lake to Christina lake and the Kettle river at Cascade. This group may be called the Rossland mountains.

The more northerly part of the Columbia system is yet too imperfectly known to permit of similar subdivision.

As we have seen, the belt of Interior Plateaus is of primary importance in the systematic orography of the Cordillera. It is difficult of delimitation. On nearly all of its boundaries the belt fades gradually into the loftier, more rugged ranges encircling it. Its limits have been compiled and drawn on the map (p. 588), after a study of Dawson's numerous reports of exploration. The limits are to be regarded as only approximate. The plateau character is obscure at the 49th parallel, but the roughly tabular form and considerable area of "Anarchist Mountain" immediately east of Osoyoos lake, seems to warrant the slight extension of the belt across the international line. The southernmost limit of the belt is an irregular line following—(1) the main Kettle river valley; (2) a quite subordinate trench occupied by Myer's creek and Antoine creek, in the state of Washington; (3) a part of the lower Okanagan valley; and (4) the Similkameen-Tulameen valley.

Usage, both official and popular, has gone far toward finally establishing the nomenclature for the immense ranges lying west of the Columbia lava plain, Colville mountains, and belt of Interior Plateaus. The Cascade range is now defined on the principle of continuity of crests, not on the basis of rock-composition. At the cascading rapids of the Columbia river the range is a warped lava plateau; in northern Washington it is an alpine complex of schists, sediments, granites, etc. In British Columbia, Dawson adopted the name "Coast Range" to enforce the view that the granite-schist British Columbia mountains on the seaboard should be distinguished from the lava-built Cascades, as

originally named, at the Columbia river. It has, however, become more and more evident, as the study of the Cordillera progresses, that rock-composition can never rival crest continuity as a primary principle in grouping the western mountains. Meanwhile, the name "Coast Range" has survived, and is, in fact, the only name officially approved by the Geographic Board of Canada for any principal division of the Cordillera.

Dawson did not fix a southern limit for the Coast range. General usage has not fixed the northern limit of the Cascade range. The solution of the problem is obvious if the principle of limiting units by master valleys and trenches be applied. The Fraser river valley clearly supplies the required boundary between the two ranges. There seems to be no other simple adjustment of the two usages, which undoubtedly sprang up because of the existence of a political boundary at the 49th parallel. It is important to note that the delimitation here advocated is not new, since it appears on two of the earliest official maps of British Columbia—those accompanying the 1859 British Blue Books, entitled 'Papers relative to the affairs of British Columbia.'

The remaining boundaries of the Cascade and Coast ranges, as well as the boundaries of the Olympics and of the Vancouver range, are at once derived from the map, and need no verbal description. These natural boundaries seem in large part to be located along structural depressions, and belong, therefore, to a type unusual in the Canadian Cordillera.

Summary.—The writer keenly feels the responsibility of suggesting many of the changes and additions proposed in the cartography of this large section of the Cordillera. The attempt to describe the geology of the boundary belt without some kind of systematic orography on which to hang the many facts of spatial relation, is veritably the making of bricks without straw. The scheme outlined above has thus developed out of a clear necessity.

The orography of the international boundary cannot profitably be treated without reference to longitudinal Cordilleran elements, often running many hundreds of miles to northward and southward of the boundary. For this reason the accompanying map is made to cover all of the Cordillera lying between the 47th and 53rd parallels of latitude.

The terms "range" and "system" are used in their common elastic meanings, with "system" more comprehensive than "range." The Cordilleran system, or Cordillera, includes the Rocky Mountain system, the Selkirk system, etc. The Cascade range includes the Okanagan range, Skagit range, etc. A system may include among its subdivisions a mountain group without a decidedly elongated ground-plan; thus the Columbia system includes the Colville mountains. But both "range" and "system," used with their respective broader or narrower

meanings, involve the elongation of ground-plan and a corresponding alignment of mountain crests. The great weight of popular and official usage seems to render it inadvisable to attempt any more systematic organization of the common nouns in this case. It has been found almost, if not quite, as difficult to organize the proper names in an ideal manner.

The basis of mountain grouping is purely topographical, and is, in the main, founded on established usage. A primary grouping recognizes within the Cordilleran body two relatively low areas, characterized by tabular reliefs, accompanied by rounded reliefs, generally accordant in altitude with the plateaus. These two areas are the belt of the Interior Plateaus in British Columbia and the Columbia lava plain of the United States. The remainder of the Cordillera—ridged, peaked, often alpine—is divided into systems, ranges, and more equiaxial groups, either by "trenches," by master valleys, or, exceptionally, by structural depressions.

The Cascade range, the Olympic mountains, the Vancouver range, and the Coast range of British Columbia, with their continuations north and south, compose what may be called the Coastal system. All the ranges east of the Rocky Mountain trench, with their orographic continuations north and south, constitute the Rocky Mountain system. The Columbia lava plain and the belt of Interior Plateaus form the third and fourth subdivisions. A fifth more or less natural grouping, yet lacking a name, includes the Bitter Root, Clearwater, Cœur D'Alene, Cabinet, Flathead, Mission, and Purcell ranges, the composite Selkirk system, and the composite Columbia system, with the unnamed system including the Cariboo mountains.

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DR. SVEN HEDIN'S JOURNEY IN CENTRAL ASIA: SCIENTIFIC RESULTS.*

THIS work, in every respect on a large scale, is thus announced:—It will "embrace the following divisions: Maps contained in an atlas of two volumes and consisting of about 120 plates.

"Text.—Vol. 1. The Tarim River, by Dr. Sven Hedin.
Vol. 2. Lop-nor, by Dr. Sven Hedin.
Vol. 3. North and East Tibet, by Dr. Sven Hedin.
Vol. 4. Central and West Tibet, by Dr. Sven Hedin.
Vol. 5, Part I. Meteorology, by Dr. Nils Ekholm.
„ Part II. Astronomical Observations, by Dr. K. G. Olson.
Vol. 6, Part I. Zoology, by Prof. Dr. Wilh. Leche.
„ Part II. Botany, by Prof. Dr. G. Lagerheim and others.
„ Part III. Geology, by Dr. H. Bäckström.
„ Part IV. Archæology, by Mr Karl Himly."

* 'The Scientific Results of a Journey in Central Asia, 1899–1902.' By Dr. Sven Hedin. Stockholm: Lithographic Institute of the General Staff of the Swedish Army; London: Dulau & Co.; Leipzig: F. A. Brockhaus.

Of these, vols. 1, 2, 5 Part I., 6 Part I., and two volumes of maps, containing 22 and 37 sheets respectively, have been received for present consideration.

As there is neither preface nor introduction to vol. 1, the *Geographical Journal*, vol. 24, pp. 524–545, containing the Doctor's description of his objects and aspirations, may be consulted. Condensing this, it is enough to say that the work is published with the assistance of the Swedish Government, that the first four volumes will contain 2000 pages, and that the atlas would probably extend to 120 sheets. The remaining volumes are prepared from Dr. Hedin's notes, observations, and specimens, by various experts. The atlas is described as the *pièce de résistance* of the entire work, the result of a mode of survey with a chronometer and a compass which "yielded amazingly accurate results." A general map on the scale of 1 : 2,000,000 was contemplated, but it was considered more expedient to have sixteen sheets on the scale of 1 : 1,000,000. In addition there are facsimile reproductions, which it is hoped may be of use to younger explorers.

The text, originally written in Swedish, had to be published in one of the great world languages; English was chosen, a compliment which we beg to acknowledge, and Mr. J. T. Bealby, B.A., translated. An explanation of the transliteration of oriental words is offered, and it is stated that "the metric system, as well as the thermometric scale of my countryman Anders Celsius" is used; "and it is not my fault if the conservatism of the English-speaking world makes these two systems less familiar than they ought to be to the readers of the book."

The text is arranged and observations are recorded so as to form a commentary "day by day and sheet by sheet to the maps in the atlas." The author imagines that readers of vol. 1 will be surprised at not finding a single quotation in its 512 pages. "It is nowadays esteemed a merit to overload a scientific work with quotations of every sort and degree; they are proof of wide reading and learning." We can assure him that any such surprise is promptly converted to gratitude on turning to vol. 2, in which the numerous and lengthy quotations, chiefly German, are a source of irritation and somewhat out of proportion in an English translation, which certainly does not require the additional weight involved.

Vol. 1 consists of four chief sections—the Tarim, the lakes on the lower Tarim, the Charchan desert, and the Tarim delta.

Vol. 2 comprises the Kara Koshan, the Kuruk tagh, a part of the desert of Gobi, the desert of Lob, and above all, the former Lob-nor.

Explanation of the arrangement of subjects follows, and the close connection between vols. 1 and 2 is pointed out; attention is invited to the illustrations—for the most part, reproductions of photographs and sketches of uncommon merit by the author, who quite unnecessarily appears to apologize for the scantiness of the records of his work.

Such, in short, are the chief subjects dealt with in vols. 1, 2, and the maps, to which at present consideration is confined.

And now a few further introductory words. The eminence of Dr. Sven Hedin as an explorer, as a contributor to the details of geography, and as an accomplished linguist, has been already abundantly and deservedly acknowledged; sometimes, perhaps, in terms stronger than may be palatable to his modesty. So of these accomplishments we shall say no more. Attention, however, is invited to his remarkable artistic powers, evidenced chiefly by pen-and-ink sketches, landscape and figure, but manifest also in his topographical drawing. Specimens justifying this praise, in which the desired effect is produced with a minimum of lines, can readily be selected from the illustrations or plates.

Passing now to the country concerned, and the problems involved in its peculiar circumstances, the former may reasonably be likened to a basin or series of basins surrounded on three sides, north, west, and south, by hills, in plan roughly like a horseshoe, highest generally at the toe, and falling off towards the heel, which is more or less open to the east towards the deserts of Mongolia. The extent is great; from Kashgar in the west (76° E. long. appr.) to Shachau in the east (95° E. long. appr.), and between lats. 36° and 42° N. The surrounding ranges are, generally: on the north the Tian Shan, the celestial mountains, culminating at Khan Tengri, and gradually wearing away eastwards, under the names Chol tagh (desert range) and Kuruk tagh (dry range); on the south, the Kuen lun, the Altin, or Astin tagh;* on the west, the Pamirs and watershed between the rivers which flow west to Lake Aral and the Caspian, and those which run east and are lost in the desert of Lob.

The great basin or desert thus enclosed is subdivided, for the sake of convenience, into two main parts: the greater, lying south and west of the Yarkand river and other waters which at present fall into the Kara Koshan lake, is called generally Takla Makan; the lesser part, east of the rivers, contains the Lob desert north of the lake, and the desert of Kum tagh (sand mountains) east and south. The Takla Makan is again subdivided into the deserts of Charchan, Keria, etc., from the names of rivers or localities.

The chief interest and great marvel of this country is found in the long-continued and possibly never-ending fight, now in full progress, between the aggressive sand from the east and the defensive water mainly from the west. It is a strange battle curiously complicated. For elements of destruction there are the variations of temperature; the disintegration of the hills, specially towards the east, the lighter

* Known by the Russian Geographical Society as Prjevalsky's range (*Geo. Jour.*, vol. 9, p. 547).

part or dust being carried to great heights and distance by the prevailing east-north-east wind; the heavier sand or gravel scoured along the land, which it furrows as it passes, driven by storms of incredible velocity, the accumulated sand being deposited, as the power of carrying it fails, in the forms of hills and waves of gigantic size. These in turn are in motion, pressing forward, forcing the rivers back, and with them the vegetation, cultivation, and population which they supported.

The defence seems, as usual, less vigorous than the attack. Rain or snowfall feeds the rivers, and though this undoubtedly varies from year to year, there is no reason to suppose that the average fall is materially less than it was, say, one or two thousand years ago. Yet during that time rivers have shortened, lakes have disappeared, trees and pasture have withered, villages and towns have been buried. When and where will equilibrium be established? The problem is difficult, possibly, in our present state of knowledge, insoluble; but as yet no scientific assistance has been given by men to what seems the weaker power, and this, wisely applied, might arrest destruction. It must also be kept in mind that the rivers, though warring against the sand, actually reinforce their enemy. For the glaciers grind the upper valleys of the catchment basin, and the silt thus generated, added to what is gathered by rain floods in intermediate parts, and scoured from the river-bed in its lower course, is deposited somewhere. If in the river-bed, that is raised till the water overflows or bursts its banks and forms great lakes or marshes, to the grievous loss of the defence through evaporation and absorption. The attenuated river passes on, repeating the process till it is exhausted, trickling by many channels through or over a delta raised by deposit above the surrounding country, and ultimately discharging into the most convenient hollow of the basin which becomes its terminal lake. But this lake itself is subject to similar change. Though naturally the greater part of the river silt is deposited before the lake is reached, yet some is carried in. Then sand and dust are blown in by the wind, and, as the depth decreases, reeds and plants appear on a scale difficult for dwellers in temperate zones to realize, accelerate the deposit and add materially to it, for they die and are reproduced annually.

If the silt is deposited outside the river-banks, it is either in lakes, which it tends to fill up, or it is formed on the surface of flooded land, which dries up as the river becomes smaller. The dry silt is readily scoured and moved forwards by the wind, augmenting the sand already in action. The river, too, is usually weakened by the abstraction of a considerable part of its volume; near the foot of the hills for irrigation, lower down for replenishing lakes whence fish are obtained. Hence, so far, man seems rather to weaken than to help the power which enables him to live.

Apart from this great problem, minor matters of interest have arisen, among them the controversy as to Lob-nor. The Chinese marked the lake on their maps where there is now no lake, and Prjevalsky during his travels came on the terminal lake of the water system, Kara Koshan, and not unnaturally called it Lob-nor. For Lob-nor was almost certainly the terminal lake of the Yarkand river and the Koncheh river from Lake Bagrash, their water being carried in a channel, Roborovski's Kum daria (sand river), better named by Hedin Kuruk daria (dry river). So, having found the terminal lake, he gave it the old name, believing that the position on the Chinese map was incorrect.

Apparently this is not so; there is evidence that the terminal lake was situated as shown on Chinese maps, and that Lao Lan, now in ruins exposed to the action of a sand-blast, was on its border. In time, doubtless under the process already described, the lake and river-bed silted up; the latter finding a new channel southwards, meeting the Charchan river in a lake called with doubtful accuracy Kara buran * (black storm), and thence passing to its final basin, the Kara Koshan lake. Curiously enough, this lake is now migrating towards Lob-nor whose bed is being fast scoured out by the wind; so that in course of time, and perhaps at no long period, the level of Lob-nor, which is being lowered, may fall beneath that of the Kara Koshan lake, which is being raised. In that case it is conceivable that Lob-nor may again become the terminal of the water system of the great amphitheatre. On the other hand, the tendency of the rivers to work westwards may defeat the chance of their resuming the channel of the Kuruk river, and their surplus water may find a more convenient outfall. The evidence of Dr Hedin seems to point to Lob-nor again becoming the terminal lake, though very likely supplied by new channels.

Of greater importance than the precise position at any moment of a changing and migrating lake, and of greater general interest, is the light likely to be thrown upon the former condition of a great part of the desert through which lay the highway between India and China, by the discoveries of buried ruins. The results of Dr. Hedin's work in this line have, no doubt, been carefully presented by the late Mr. Karl Himly. Dr. Stein, who (1900–1) was deputed by the Government of India to explore these remains systematically, whilst generally confirming Hedin, has greatly added to the value of his observations. Materials and implements of art or industry have been unearthed, and, more important still, many Kharoshthi documents, marvellously preserved, containing "records written as early as the third century of our era,

* Kara-boyön (black isthmus), M. V. Pyevtsoff's expedition (*Geo. Jour.*, vol. 9, p. 552).

and dealing with a wide range of matters of administration and private life" * in the sand-buried settlements, have been found.

These discoveries will help to enlighten us concerning the spread of Buddhism from India to Central Asia, China, and Japan; taken with the accounts of the reverse journeys or pilgrimages to sacred spots in India, they cannot fail to add materially to our present knowledge. One example is that by means of these writings it is possible to define the periods of the invasion of the sand into the buried ruins as extending from the third to the end of the eighth century A.D., and thus a measure of its victorious advance is obtained.

That and other evidence respecting the Takla Makan naturally lead to inquiry into the general question of the desiccation of the old world. Prince Kropotkin, in a highly interesting paper (*Geo. Jour.*, vol. 23, p. 722), stated his opinion that recent exploration confirmed the view that victory inclined to the battalions of sand: evaporation exceeded precipitation, and year by year the desert encroached on land which yielded pasture or was fit for cultivation. Desiccation, in short, was a natural reaction from the glacial period. It may be so, but, as Dr. H. R. Mill remarked, the water-vapour in the air is probably much the same in quantity during historic time; consequently, local desiccation is the result of unequal distribution. If the plateau regions are drying up, there is presumably compensation elsewhere.

The foregoing are the salient points of interest respecting this strange country as they occur to one who has considered the problems involved, both in the study and in the field. For similar features are present on a smaller scale in rivers and deserts of the Punjab; causes and effects are much the same, whilst their observation, record, and the power of making legitimate deduction, form part of the training of an irrigation engineer.

Passing to the consideration of the records vols. 1 and 2, their title, "Scientific Results," is somewhat misleading. They contain rather the profuse detail from which results might be condensed. In describing his journey on the Yarkand river from Lailik to Kuruk-Asti, the author thus sets forth his idea of what he had to do: "The task, therefore, which I have set myself in the following chapters, is to present a detailed description of the geography of the Tarim. I shall deal with the river-bed and its varying conformation in different parts of its course, as well as with the changing character of its erosive action upon the surface of the regions it flows through. The bends or sinuosities of the river, its silt beds, its alluvial deposits, its banks or erosion terraces, and their varying character according as the stream makes its way through forests, steppes and sand-deserts, or washes the foot of detached mountains; the highways, the riparian population and all that

* 'Sand-buried Ruins of Khotan,' Stein, p. xx.

concerns them, the irrigation canals, the navigation of the stream, and its fisheries—all these will be successively dealt with as far as my observations, and the information I gleaned about them, will admit. And I shall everywhere give the geographical names which are used in connection with the river itself, or in the immediate vicinity of its banks."

All this the author has done most conscientiously, perhaps in greater detail than the occasion warranted. For his surveys of six or seven years ago, and the maps so beautifully made from them at the Institute of the General Staff of the Swedish Army, are probably materially different from the present course of that most unstable river, and certainly in ten or fifteen years more may be nearly unrecognizable. The geographical names, too, are for the most part ephemeral, and in time may probably give way to new ones, for they chiefly define some transient incident on or near the river-banks.

Many measurements of the various rivers were made, the process being described on pp. 28–33, vol. 1. It was rough, no doubt—under the circumstances, nothing else could be expected; but so long as there is no insistence on the accuracy of any one observation, deductions from them being based on differences between the results of similar observations, students will not be misled. The use of the metric system and the adoption of a remarkable method of transliteration of oriental words render the English version of the book unnecessarily troublesome to read. As regards measurements, there may be reasons why foreign standards should be used in preference to English in an English translation, but they are not self-evident. No doubt centimetres, metres, and kilometres can by the aid of tables be converted into inches, feet, or miles; but the advantage of having to do so does not compensate for the waste of time involved. And what is to be said of versts and saschen, not to mention terms in the local vernacular? Of this, indeed, a far too liberal use is made when English equivalents are available; many sentences must be unintelligible to those not acquainted with oriental languages, whilst the transliteration of native words makes them a puzzle to those who are. The following extracts convey a notion of what is meant and of the trouble involved in reading the book: "After passing a fresh jarsik we came to the district of Tschimälelik, and beyond it to a couple of sharp bends with a boldschemal, and, on the left, a lateral bed called the Jäkänlik-boldschemal, thirty-five years old; it contained stagnant water. . . . At Jäkänlik-tüschkün . . . there is a little *ortang*, no longer in use. Below it an arik (now dry) is led off to the *jajlaks* (or 'pasture grounds')." And so on, whilst English scholars of oriental languages are vastly exercised to recognize familiar words in the clothing which has been adopted. Thus Tschahr bagh (chär bägh?), mätschit (masjid), tschätschäk (chechak = small-pox); Tschaj (chäe = tea); Ciarcian, Tschertschen (Charchan); whilst Muhamede-

godsche-tutghutshtake-uji, "the house where M. collected feathers," is a puzzler. We do not for a moment venture to criticize the taste or accuracy of those who prefer oriental words in such disguise, but surely the lavish use of consonants must hamper competitors in the struggle for life.

Another difficulty which caused delay and unnecessary labour in reading vols. 1 and 2 is that there is great want of reference in the text to the particular sheet of the maps concerned, and also occasionally reference to maps or plates which could not easily be identified.

Having thus relieved our feelings, we may suitably record admiration for the endurance, physical and mental, which is attested first by the exploration involved, and next by the preparation of its record. The details of the dune formation are of great interest, and may with advantage be compared with the snow-waves and drifts described by Dr. Vaughan Cornish (*Geo. Jour.*, vol. 20, p. 137); some of the reproductions from photographs showing the wind-ripples on the dune surface are most beautiful specimens of the art, and very suggestive.

As regards vol. 5, Part I., it must suffice to mention that it contains elaborate tables with a brief explanation, and that vol. 6, Part I. treats of the zoology of the country. The plates in this volume are of remarkable excellence, both those in the text and the full-page collection of skeletons at the end. Throughout the work there are very few printer's errors, and they are of little consequence.

W. Broadfoot,
Major R.E. (retired)

RECENT EARTHQUAKES.

We may anticipate, with confidence, that the earthquake of April 18 will take a place in the annals of seismology only second to the Lisbon earthquake of 1755, or, if not in seismology, at any rate in popular histories of earthquakes, and for the same reason. Both were earthquakes of the first order of magnitude; the Lisbon earthquake was probably the second greatest of which we have any historic record, and that of San Francisco, though excelled by several, is still a very great earthquake, yet both would have passed with little notice but for the destruction to which they gave rise, and in both cases this destruction of life and property was only to a slight degree the direct result of the earthquake proper. In Lisbon the death-roll was due to the great sea wave, and in San Francisco to fire. The special correspondent of the *Times* has estimated that only 3 per cent. of the damage in San Francisco was directly due to the earthquake, the remaining 97 per cent. being due to fire, and in Lisbon the proportion was probably much the same; so great is the power of the familiar elements of fire and water as

compared with that of earthquakes, greatly as the latter impress the popular imagination. Like artillery in warfare, their moral effect is out of all proportion to the amount of material damage they cause.

Apart from the magnitude of the disaster, popular interest and popular alarm were excited by the short interval which separated it from the great eruption of Vesuvius. People began to wonder whether there was any connection between the two, and whether the world we live in was getting unsafe; this wonder found its reflection in numerous articles in the daily press, and in interviews with a number of persons whose opinions for and against the existence of a direct connection between the two catastrophes have been reported. As we have, in almost every case, only the interviewer's version of these opinions, it would not be fair to quote them, but the matter is one of considerable interest, and it may be well to point out what can and cannot be known regarding it.

Volcanic eruptions and great earthquakes differ radically in their immediate cause. Small earthquakes may be due to any cause which can start an elastic wave-motion in the Earth, but the really great earthquakes, so far as is known, are always started by the sudden fracture of the solid crust of the Earth. In some way not fully known, though probably it is more or less directly connected with the gradual cooling of the Earth, the Earth's crust is thrown into a state of strain which ultimately grows too great to be borne, and fracture takes place. Where the power of resistance is small, the accumulated strain is also small, and so, too, the resulting disturbance; but where the power of resistance is great, the strain also becomes great before yielding at last takes place, and then the disturbance, often accompanied by permanent displacements of the ground, carries destruction in its wake. The occurrence of a really great earthquake means, not only a greatness of force, but also of resistance; it is due to the disruption of solid rock.

In a volcanic eruption the conditions are radically different. Here, too, much is still unknown, but it is certain that an active volcano means the existence of a large body of molten rock, either actually in a fluid condition, or at such a temperature that only a relief of pressure is necessary to make it pass from the solid to the fluid state. It must not be supposed that this fluidity is due to heat alone, the magma is permeated with water, and the condition of the lava in the volcano's neck is a sort of compromise between fusion pure and simple and aqueous solution; but however its state may be defined, the important point is that the rock immediately concerned with the cause of the eruption is virtually in a liquid state, while that which is directly concerned with the production of great earthquakes is virtually solid.

In view of this radical difference in cause and in effect, it seems at first sight as if there could be no connection between the two; seismologists have, in fact, recognized that the neighbourhood of active volcanoes is not specially liable to earthquakes, though the

disturbances which accompany or precede a volcanic eruption may start tremors of that nature, and the districts where earthquakes are most frequent and most violent are always removed, and often far removed, from active volcanoes. The absence of direct connection of the nature of cause and effect between these two classes of phenomena does not, however, preclude the possibility of both being consequences of a common cause, which has been described as the reaction of the interior on the exterior of the Earth, a phrase which will be found in many text-books of geology, and of which we may say that it represents a reality whose precise nature and limitation we are unable to define.

Whatever the character of this reaction, its manifestation is certainly liable to periodic variation; the last twelvemonth has been one of more than average frequency of great earthquakes, and has witnessed more than an average, though not an exceptional, development of seismic and volcanic activity. The Kangra earthquake of April 4, 1905, the two Central Asian earthquakes of July 9 and 23, the Colombian earthquake of January 31 last, and the San Francisco earthquake of April 18 were all disturbances of the greatest magnitude, but the total amount of seismic activity was probably no greater than in 1897–98, and there is no indication of any spreading out of great earthquake centres from the regions whence they commonly originate. The distribution of earthquake centres is curiously localized, and those of the greatest earthquakes are limited, so far as experience goes, to certain areas which do not cover more than, at most, 5 per cent. of the Earth's surface. Great Britain lies well outside any of these regions, and, so far as our country is concerned, there is no reason to anticipate the slightest probability of an earthquake such as led to the destruction of San Francisco.

Our knowledge of this earthquake is at present dependent on newspaper reports, and the facts, so far as they can be gathered with any certainty, have been noticed elsewhere in this *Journal*, but a few words may be devoted to the position of the origin of the earthquake. At first the tendency was to place it under the sea, as nearly all the great earthquakes of the west coast of America have submarine origins, and Dr. Davison, writing in *Nature* of April 26, has drawn the same conclusion from a comparison between the time of the earthquake, as given by the newspapers, and the time at which the disturbance was recorded on European seismographs. As we do not know what the probable error of the newspaper time may be, we cannot attach great weight to this deduction, and there are indications that the centre of the disturbance lay not far from San Francisco itself. The breakage of the water-mains, the consequence of which was so disastrous, could hardly have taken place at a distance from the epicentre; it implies a displacement of the ground and alteration of levels, which might be produced by landslides, but otherwise would only be produced near the origin of the earthquake, where there is often a permanent displacement of

ground-level, as opposed to the temporary molecular displacement in the region over which the disturbance is propagated as wave-motion. The extreme violence of the disturbance, as evidenced by the nature of the destruction of the buildings at Palo Alta, and the narrow localization of this extreme violence, are phenomena which characterize the epicentral region, taken in conjunction with the reported production of a surface fault in the Red hills close by, point to the conclusion that the centre of this earthquake lay under dry land to the south and south-eastward of San Francisco, and not under the sea.

There is another aspect of this earthquake which we hope will find a historian. The story of San Francisco during the weeks which followed the earthquake is not only full of the usual tales of heroism and cowardice, of self-restraint and licence, which repeat themselves when the social system becomes disorganized, but is also full of interest for the sociologist, and therefore also for the geographer. We have seen how a large and highly civilized community has, by the sudden destruction of the whole machinery of that civilization, been temporarily driven to the primitive methods of forced labour and artificial regulation of prices, and the history of the fall and rapid resurrection of the city of San Francisco, as a social organization, will form one of the most interesting and instructive episodes in the history of the world if it is fortunate enough to find its historian.

R. D. O.

RUWENZORI.

The following note and letter are taken from the May number of the *Alpine Journal*:—

On February 16 Messrs. A. F. R. Wollaston, R. B. Woosnam, and R. E. Dent, starting from Bujongolo (12,660 feet), reached the foot of the Mubuku glacier in two hours. They followed the edge of the glacier to 13,560 feet, then turned away to the rocks on the right, up a steep gully full of loose stones, water, and moss, to about 14,000 feet, then sharp back horizontally on to the glacier near the beginning of the icefall. Thence, keeping near to the base of the rocks on the right (true left of the glacier), by an easy slope to the watershed at a point called by Herr Grauer "King Edward's rock."* Herr Grauer reached the same point on January 18, 1906, by a somewhat different route. View down into the Congo side mostly obscured by clouds. Rocks between 13,500 feet and 14,000 feet not difficult, but dangerous, owing to loose stones and water. Numerous avalanches falling from Duwoni peak, on the right; can be mostly avoided by keeping towards the middle of the glacier. Time from Bujongolo to the ridge in wet weather, five and a half hours.

On February 17 Messrs. A. F. R. Wollaston and R. B. Woosnam, starting from Bujongolo, left the Mubuku valley half a mile above the camp, following the first stream that comes in from the left. Over a low hill into the valley coming from the Kiyanja glacier. Three hours through trackless swamp and moss and

* 15,100 feet by aneroid, 14,956 feet by boiling-point thermometer.

bushes of everlasting flowers. Crossed the stream coming from Kiyanja glacier, about 13,500 feet. Thence up a steep gully to the left (west), and on to loose boulders and screes at 14,000 feet. Turning north, good granite rocks were reached at 14,800 feet, which led to the glacier on the south-west side of the mountain at 15,500 feet. Thence up over easy ice and snow to Kiyanja peak—16,125 feet aneroid, 16,000 feet by boiling-point thermometer. The last three hours in dense fog, which misled the party to the lower of the two tops of the peak. At the moment of starting to descend, the true top, a snow-mound connected with the point reached by a short snow *arête*, was seen to be, perhaps, 150 feet higher. There seem to be no higher peaks than this on the Uganda side of the range, but at least three on the Congo side—one north-west, about 16,800 feet, and two to the north (? Saddle mountain), perhaps 17,000 feet. Rocks easy and good going. Moss and bog at the foot of the mountain very heavy and tiring. Time from Bujongolo to the summit, about six hours.

A. F. R. W.

A private letter from Mr. Woosnam adds some interesting details as to an earlier expedition.

"Ruwenzori, February 2, 1906.

". . . I have been away with Cruthers for a ten days' expedition up to the snow, and missed the mail. It is absolutely the most extraordinary country up high that you can think of. Look at Sir H. Johnston's photographs of high ground; they are good. I have now been to the exact places and seen the same things, and taken photographs of them. Most extraordinary, but a photograph can't give any idea of such a place, nor any description on paper. I will tell you all. It is beautiful, and terrible, and delightful, and yet horrible. The extraordinary vegetation—forest, then bamboos, then giant heather and bog, all hanging with long grey lichen, masses and yards of it, and half covered up in soft deep moss and what R. calls 'rot of ages' (right too), and the great tall thin posts of lobelias, taking many years to grow and die (I am sending you good dry seed of them); then higher, at 12,500 feet, only moss and lobelias and huge trees of groundsel left, and then the lobelias go, and only groundsel and moss and everlasting flowers, and at last only moss and glacier and snow, and, highest of all, rock.

"We have got some glorious new birds from high up, just below the glacier—most surprising and unexpected birds and animals. It was a little cold, but not very; but we had remarkably fine weather, *no rain* and little mist.

"We did a surprising thing. We also reached the watershed, the same point reached by Grauer and the missionaries, and this is how it came about: The first morning after we got up and camped at 12,500 feet, being a fine day, we started early to walk up to the glacier, to have a look at it and see what birds were there. There were very few birds here—in fact, few above 10,000 feet. When we got to the foot of the glacier, we took the spoor of Grauer's party, which was still quite fresh, and followed it up the rocks on the right (the true left) of the glacier. We soon came to a place which is described in Sir H. Johnston's book* as a 'tunnel.' Here we found no less than seven ropes hanging down, of different sizes. It is not really a difficult place to climb, so we took most of the rope back to camp with us on our return. The place is not a tunnel cut by water through the rock at all, but a great flat stone fallen across or lying across a water-worn crack or channel. After we had gone up about 500 or 600 feet we lost all traces of Grauer's party at

* 'The Uganda Protectorate,' vol. 1, p. 184.

a point where they had left a tin with their names the first day. We knew that they had gone up the rocks higher than this before getting on to the snow, but the glacier looked to me to be quite climbable if a few steps were cut in it; but C. wanted to keep to the rocks, so he went to try the rock, whilst I tried to get up the glacier; and, with the help of my hunting-knife, I cut about forty or fifty steps in the ice and got up on to the middle of the glacier. By this time C. had got as far as he could go in the rocks, and came back to where I had got on to the glacier, and tried to follow me up, but failed here also. I was so afraid of mist coming on and spoiling the view from the top—for I could see now that, unless there was a crevasse, I could easily walk right up—that I could not go back to show him the way. So I just walked right up the snow to a black rock on the ridge; and when I got there (it was hard work breathing) I found I had got to Grauer's highest point (my aneroid read 15,100 feet), and found a tin with the three names (Grauer, Maddox, and Tegart); so I put my card into the tin too, with a rifle-cartridge.

"I had a fairly good view over to the Congo side, and took some photos (the first that have ever been taken, as it was misty when they were here). They called this rock 'King Edward's rock.' There is a little lake down below on the Congo side, probably unknown. I could not, of course, see very far, as there were more hills beyond, but lower, and undoubtedly I was on the watershed. I might have gone on to a higher ridge on one side, but I was a bit tired with the altitude, and wanted to get back to C., as we had a long way to get back to camp before dark, so decided to turn back. I came down pretty fast, sliding over the snow, and sliding or falling down most of the glacier, for the steps I had cut had melted nearly away. I found C., and we had some lunch and returned safely to camp. My opinion is this: that there is no point on Ruwenzori higher than 17,500 feet; that the highest point is bare rock, not snow; and that on a *fine* day it is not hard to climb to the top, but on a rainy and misty day it must be awful. We were lucky, and had fine dry weather. My aneroid read 15,100 feet, but that is about 150 feet too high, for Grauer took the same point by boiling-point and made it 14,956 feet."—R. B. W.

Mr. D. Freshfield adds the following note:—

"Mr. Wollaston, it will be noted, has, as I foresaw, conclusively disproved Mr. Tegart's suggestion that Herr Grauer's rock is higher than Sir H. Johnston's Kiyanja. With regard to the lofty peaks on 'the Congo side' of the range noticed by Mr. Wollaston, it is quite possible that the double summit, of which I had a distant view from Butiti, may lie (like the Orteler) near, but off, the watershed, and not be identical with Johnston's and Wollaston's Duwoni. But the photogravure and panoramic plate of the range from the west, published by Dr. Stuhlmann, show no detached and lofty spurs running out towards the Semliki. There are obviously plenty of topographical questions left for investigation by the British Museum party and the Duke of the Abruzzi's Expedition. I regret to hear that there is trouble with the natives in the district at present administered by the Congo State on the western side of the mountain, which may probably hinder exploration.

"D. W. F."

DR. SVEN HEDIN IN PERSIA.

We give the following extracts from a letter from Dr. Sven Hedin, dated Seistan, April 14:—

When I decided to take the route out *viâ* Turkish Armenia, Persia, Seistan, and Baluchistan, it was only that I should not miss the opportunity of seeing

those countries, and get a vague idea of what they are like during a rapid journey. I should cover those 3000 miles in a hurry. So I did from Trebizond to Teheran, but from there to Seistan it has been serious work, and I have never during all my previous journeys worked so hard as from Teheran to Seistan. It is no exaggeration at all to say that I have been at work sixteen hours a day. You may imagine, therefore, how very satisfied I am with the results. I have written 1200 pages of notes and geographical observations, *i.e.* one-third of what I wrote during the whole of my last expedition, which was 3600 pages of exactly the same kind. If I go on like this for the future, I shall bring back much more material now than in 1889–1902. Further, I have mapped the route in 162 sheets, in the same way as during my previous journeys, and I have had many occasions to make very important corrections on our latest maps of the interior of Eastern Persia. It is a complete mistake to believe that this country is well known, and that trained travellers would have little to do. My plan was to cross Persia in two months, and I have been three and a half on my road from Teheran, and now I have the feeling that I have left behind me years of hard work in the Persian deserts. By no means had I an opportunity to do all that I should like to do. I continued as long as possible, and it was only the heat which compelled me to go on at last straight to Seistan. And now it is a half-done work I have left behind me; that is to say, the itinerary and everything around it is well and thoroughly surveyed, but I should have been able to carry out twenty side expeditions to right and left if I only had had time. The Great Kavir fascinated me for a time. It is the bottom of a big inland lake, full of salt mud, level as a sheet of water; not the smallest ridge of hill is to be found there. My route went down from Veramin to Siah-kuh and Kuh-i-Nakshir, where I got the western "shore" of the Kavir sharply drawn as any strand-line; then I crossed a branch of the Kavir between the great salt desert and the Hauz-i-Sultán lake and its Kavir. Further, I went to Ashin, Alam, Chupunun and Jandak, where I left the whole of my own caravan and the Cossack escort given me by the Shah, and hired four camels and took two men with me, and crossed (without tent) the great Kavir, 30 farsakhs to Payestun, whence I went north-east to Turut. Then we continued south 40 farsakhs once more through the great Kavir, of which I am able now to make a very good map—of course, using all the native information I have got from all around its boundaries and all previous exploring material. The season was rather unfavourable; there was a good deal of rain, which made it extremely difficult for the camels to walk in the salt mud, and I had to do most of it on foot. Arrived in Arusun and Khur, we continued on to Tabas, one of the most charming oases I have ever seen, with real forests of palm trees. From Tabas I went to Parvadah, and made a trip of a couple of days into the Bahab-ad desert ("unexplored" in the latest English map), and turned eastwards to Naiband, which is much more charming than Tabas—that is enough to say. I had from Teheran fourteen camels of my own, of which two were left, but I usually hired six or eight camels also for carrying the camels' supplies. Now, in Naiband it was very hot weather, and as the great Lut is waterless all over, I would not have the camels to suffer in this desert, and I was already one month and a half delayed, and so went on to the east *viâ* Sar-i-chah to Neh, and thence to Nasratabad.

I have collected two hundred specimens of rocks, and at two places I have found fossils—no good specimens, but, as I hope, sufficient for fixing the horizon. At every camp (sixty-eight) I have made a panorama sketch of the surrounding mountains, if there were any, which happened to be the case at about fifty camps. Most of the panoramas are $2\frac{1}{2}$ metres long, and some of these are coloured. I had seldom time to colour them, but in this case made annotations as to the natural

colours. This is a branch I have never tried before—at least, not on the same scale as now, and I am glad to hear from the British officers here, when I have showed them, that they give a wonderful good idea of what the country is like. Anyhow, I have drawn them *con amore*. Then I have taken more than a hundred portraits (pencil drawings) of natives, much finer and more elaborate than those you will find at the end of vol. iv. of 'Scientific Results.' This has also been a great pleasure to me—they give a good idea of the East-Persian type. And last, but not least, I have taken some four or five hundred photos—hundreds of which I developed in Tabas.

Dr. Sven Hedin speaks in the highest terms of the services rendered him by Major Sykes, and of the kindness of British officials in Seistan and elsewhere. He was to leave in two days after the date of his letter for Simla and Tibet.

REVIEWS.

EUROPE.

Mediterranean Sketches.

'Mittelmeerbilder.' Von Dr. Theobald Fischer. Leipzig u. Berlin: B. G. Teubner. 1906. Pp. vi., 480.

The well-known authority on the Mediterranean basin, who is Professor of Geography at Marburg, has collected together, from various journals, a number of short articles written during the past five and thirty years. A good many of them are political. All are based on actual visits to the lands with which they deal, namely, North-West Asia Minor, the Balkans, Palestine, Southern Italy, Sicily, Corsica, Southern Spain, and North-West Africa. All, moreover, are of a popular nature, and are republished without references or maps, but with a fairly full index. The most interesting at the present time are perhaps those on the "Geographical and Ethnographical Basis of the Eastern Question" (concerned, however, only with the Balkan lands), some sections on Palestine (we note that the author accepts both the Rift theory of the Ghôr and the reality of the convulsion which overwhelmed the Cities of the Plain), and those on Morocco and the French action in Algeria and Tunisia.

An Englishwoman in Russia.

'Russia: Travels and Studies.' By Annette M. B. Meakin. London: Hurst & Blackett. 1904. Pp. xx., 450. *With Maps.*

One has learnt to expect something beyond the ordinary narrative of a traveller from Miss Meakin. Even though she may not deviate from the usual lines of communication, she makes opportunities, and uses them to the full, of observing unfamiliar aspects of life in places that are superficially well known (so far as that can be said of any part of the Russian Empire). In the present interesting volume, for example, she details visits to St. Petersburg, Tver, Moscow, Novgorod, Kharkov, the Crimea, Odessa, Kiev, and the Caucasus, and other places and districts of familiar name. In a case of this kind, the customary account of things seen might have become wearisome. Miss Meakin's is wholly the reverse. For example, at certain points we meet with a close inspection of the conditions of life in some of the great factories; this is one of many instances where Miss Meakin has penetrated beneath the crust of general knowledge about Russia. And it is not to be

supposed that her journey was confined to these well-known cities and districts. She describes such interesting towns as Pskov, for instance, whereof no more than the names (if even these) will be familiar to the majority of her readers. Throughout, the duplication of descriptions by former writers is avoided as far as may be, but, on the other hand, the authoress judiciously draws on authorities for historical notes to enhance the value of her own record. Finally, there are important passages in her book which will attract at once the geographer and the ethnologist. Such are her treatment of the distribution and characteristics of the Finns, of the German "colonists" also, and the distinctions of habit and temperament between them and the Russians, together with the interesting little sketch of the Setukese Ests. The maps accompanying this excellent volume are merely diagrammatic, but there are satisfactory reproductions of good photographs.

ASIA.

Moslem Geographers on Western Asia.

'The Lands of the Eastern Caliphate.' By G. Le Strange. Cambridge Geographical Series. University Press. 1905. Pp. xvii., 536.

The learned author of 'Palestine under the Moslems' and 'Baghdad under the Abbasid Caliphate' has continued his indefatigable labours with a summary of the Moslem authorities for those Asiatic provinces of the Caliphate which lay outside Syria and Arabia. He terminates his survey with the conquest of Timur. So far as the book goes, it will be an invaluable aid to historians, not only of Islam, but of the Byzantine and Sassanian realms. The pity is that the author was evidently prepared to make it go farther, had it been possible to find means of publishing all his material. Is it out of the question for the Cambridge Press to increase our debt by issuing a supplementary volume of documents, *e.g.* itineraries? The material, which Mr. Le Strange summarizes, is so little known, and much of it is so difficult of access, that the usefulness of his book would be multiplied tenfold if he could set before us his evidence as well as his conclusions. Again and again he refers to itineraries, etc., in which he says the mass of the entries are unrecognizable, and therefore of no avail to him. But there is often wisdom in a multitude of counsellors; and if those who have made a special study of, *e.g.*, the Byzantine geography of provinces which passed under the Caliphate, had those lists to puzzle over, it is at least possible that many of their riddles might be read after all. Such an addition is the more desirable because, owing to the brevity necessarily imposed on Mr. Le Strange by the inclusion of his book in a student series, we are often left uncertain whether statements are merely transcribed from the Moslem geographers, and given on their authority only, or whether Mr. Le Strange intended to criticize and control them. For instance, on p. 147 it is stated without comment, "Tûḳât lies to the west of Nîksâr, on the road to Amâsiyah." Is that what the Moslem geographers say? Very likely; but it can never have been correct. The ordinary road from Niksar to Amasia goes nowhere near Tokat, which lies some 20 miles south; but, of course, an official post service may have made this long *détour*. We should like to see the documents. Again, on p. 129, we read, "The fortress (of Hârûnîyah, one march west of Mar'ash) lay in a valley to the west of the Lukkâm mountains, a name by which the Moslem geographers roughly indicate the chain of Anti-Taurus." But in what sense is "Anti-Taurus" here used? No present usage will include mountains one march west of Mar'ash. These must be either the Eastern Taurus or Amanus. Does Mr. Le Strange mean one of these ranges? If so, it is either a new or a very "rough" use of "Anti-Taurus." On p. 133 the Lamos river, once the Arab frontier towards the Byzantine Empire, is said to lie "one march" westward

from Tarsus. One is curious to know in what sense "march" is used; for the distance as the crow flies is 50 miles, and by any practicable road, something more. So, here and there the student, in reading a section of Mr. Le Strange's book on which he has any special knowledge from other sources, is checked by statements which conflict with that knowledge, but are very probably justified as transcripts from the Moslem authorities. For example, are Davalû and Ḳarâ Ḥiṣâr of Nigdah really given by those authorities as distinct places? They are one and the same at the present day. On what ground is Abulustân or Al-Bustân (Byzantine Ablastha) equated with Arabissus, which lies 10 miles west of modern Albistan, and survives, name and all, as Yarpuz? Why, again, if Barbarossa was drowned in a river near Selefkeh, should it be in the Lamos, 20 miles away, rather than, as has always been supposed, in the greater stream, the Calycadnus, which flows by the town itself?

In picking out these little points, we intend not the smallest depreciation of a book which we regard with profound respect, and hail as an invaluable aid. We wish only to illustrate the immense service which an additional volume would render if it put the author's documents also before us. As Mr. Le Strange's book stands, it is rather of the nature of a *Fuhrer* through the maze of Moslem authorities—an index *raisonné*, for which we can only be devoutly thankful, as an instalment; for no one else, writing in our own tongue, could have given it to us. To any one who has worked at the earlier geography of any part of what became the Moslem empire, without consideration of the Moslem geographers, it is full of new lights and revelations of one's ignorance. Why has there been so much dispute about the true derivation of the modern name of Ephesus, Ayâsulûk, if all the time, as Mr. Le Strange now tells us, that name was also written *Ayâthulûk*, which implies, on the face of it, Agios *Theológos*, not *Loukas*, still less any Turkish word like *Suluk*? Such is one very minor count in the debt under which the author and his publishers have laid us, and we can only congratulate both on the production of a piece of scholarship so creditable to British learning, while, at the same time, we venture to reiterate a humble but insistent request for more.

AFRICA.

Egypt.

'The Making of Modern Egypt.' By Sir Auckland Colvin. London: Seeley & Co. 1906. Pp. xiv., 428. *Portraits and Maps.*

This able and authoritative account of Lord Cromer's proconsulship by one who has co-operated with him on the all-important side of finance, hardly touches geography except when it deals with the Sudan. There are certain aspects of the making of modern Egypt, indeed, which might fairly claim the attention of geographers, notably the modification of the natural conditions by the recent developments of irrigation. But the author passes very rapidly over the history of the dams, even that of the original barrage, and hardly deals at all with the Delta reclamations. Nor does he go in detail into the effect of these and other British achievements upon the Nilotic peasantry. He is content to leave these matters to be gathered from Lord Milner's book and others' (*e.g.* that of Mr. Silva White), and proclaims his own task to be rather the history of the administrative machine at headquarters. But when he comes to the present condition and future of the Anglo-Egyptian Sudan, he dwells more on problems which are essentially geographical, such as the utilization of the Gash and Atbara rivers, the question of the *sudd* and the marsh area south of the Sobat, the present distribution and future expansion of Sudanese products, the actual state of Sudanese population,

and the development of railways and other means of communication. He does not seem to regard the proposed new cut of some 400 miles from Bor to the Sobat mouth as yet within the range of practical politics, while at the same time he is fully aware that the utmost which sudd-cutting operations will ever achieve is only a very slight amelioration of the conditions. In fact, the labours of Major Peake and others have had more relation to making the White Nile navigable than to increasing the summer flow down into Egypt. If the marshes are ever drained, or even greatly diminished, it remains to be seen whether the rainfall in the upper Nile basin will be affected by the contraction of the evaporative area, and whether a serious loss in that way will have to be set against the gain from the freer flow. The re-conquest of the Sudan is too briefly described by the author for any light to be thrown on military geography, but there are some illuminating passages concerning the whole Gordon episode. Having to write largely about the work of living men, Sir Auckland Colvin has to refrain almost entirely from criticism, and this fact should be borne in mind by any who are inclined to carp at the almost unrelieved optimism of the book.

AMERICA.

Argentine Republic.

'Geografía Argentina; Estudio Histórico, Físico, Político, Social y Económico de la República Argentina.' *With Maps.* Por Carlos M. Urien and Ezio Colombo. Royal 8vo, 688 pp. Buenos Ayres: 1905.

'Geografía de la Provincia de Córdoba.' Por Manuel E. Rio y Luis Achával.' Official publication. 2 vols., royal 8vo. Vol. 1, 668 pp.; vol. 2, 569 pp. Buenos Ayres: 1904.

The first-named work, replete with information regarding the Argentine Republic, treats of the history of the country, its limits, political divisions, commerce interior and exterior, finances, railways and river navigation, literature, fauna, geology, orography, and, in fact, nearly every subject which can interest those who take an interest in the past and future of that remarkable land, which is now so attractive to the European emigrant.

Each province is extensively described in detail, and its agricultural and pastoral products, climate, orography, hydrography, limits, area, and industries are well outlined. The whole volume presents evidences of having been prepared with the greatest care with a view to making it a standard work.

It is not usual to find the provincial governments of South American nations paying such marked attention to geography as is indicated in the two voluminous tomes supplied by Sr. Achával. They do credit, not only to the governor of the state, but to the civil engineers who have collated and classified the vast quantity of information they contain in great detail, and upon almost every imaginable subject which can be included under the name of geography. The work shows ample evidence of having been written with that accuracy due to its serious nature, and is replete with facts and valuable statistical data regarding one of the most beautiful, diversified, and interesting provinces of the Argentine Republic.

South American Ethnology.

'La Edad de la Piedra en Patagonia.' By Felix P. Outes. Buenos Ayres: 1905.

By this masterly treatise on 'The Stone Ages in Patagonia,' which forms the twelfth volume of the *Anales* of the Buenos Ayres National Museum, Señor Outes has supplied a want that has long been acutely felt by students of primitive man

in Austral America. Much had, no doubt, been written on the subject by several competent observers, such as Moreno, Ameghino, Lovisato, Hyades, Martin, Ambrosetti, Burmeister, and others; but these pioneers all worked independently of each other, and their essays lie for the most part buried amid official records, or scattered over scientific periodicals scarcely accessible to the general public. But here we have at last a splendid monograph, which covers the whole ground from the Rio Negro to Tierra del Fuego, and offers reasonable solutions of the many obscure problems associated with the advent and evolution of early man in those southern lands.

Despite its great size (over 300 quarto pages), the author assures us that the volume forms but a mere fraction of a comprehensive work which he had intended writing on *Los primitivos habitantes de Patagonia*, but had to give up owing chiefly to the impossibility of first surveying the whole field for himself. Hence this instalment is merely to be regarded as a descriptive and comparative study of the rich archæological materials contained in the numerous public and private local collections available for the purpose. These remains have all been most carefully examined, their provenance verified, and their value thus thoroughly established as primary factors in the attempt to unravel the tangled history of human origins and culture at the southern extremity of the New World. The work, which is throughout conspicuous for systematic treatment and scrupulous care in the study of details, is disposed in three sections, with a *résumé* (in French), followed by analytical, geographical, and general indexes, a long list of authorities forming a nearly complete bibliography of the subject, and a most useful archæological map of Patagonia, clearly showing by various graphic devices the sites of stations, workshops, burial-grounds, caches, and other isolated finds between the Rios Negro and Gallegos (40° to 52° S.).

In the first section, "The Physical Environment," geographers will find an ample account of the whole region, its geology, flora, fauna, climate, hydrography, and areas of dispersion, with special reference to its early and later inhabitants. Here a full account is given of the present Patagonian groups, their somatic and psychic characters, speech and numeral system, religious views and practices, social usages, funeral rites, constitution of the family and the clan, with general "anthropo-ethnological conclusions."

Then follows Section II., "The Palæolithic Period," in which, against northern scepticism, the author unreservedly admits the presence of Quaternary (Pleistocene) man, recognizes eight undoubted palæolithic stations or deposits, and determines two Pleistocene types—a brachycephalic arriving from the north-west, and a dolichocephalic from the north-east. On this crucial point Señor Outes writes, "The palæolithic deposits so far met number eight, distributed over a wide geographic area between the parallels 43° 45′ and 49° 50′ S., and all lying near the Atlantic coast. In the form of the deposits, the types and technical art of the objects, they belong to the Patagonian Quaternary beds, which belong without any exception to one and the same archæological epoch. On comparing the Patagonian palæolithic industry with the European, we find a great resemblance of forms, etc., with that of the Acheulean epoch—that is to say, with the more finished types of the lower palæolithic." He also finds a striking resemblance to the Egyptian, Tunisian, Algerian, and especially United States (Trenton) palæolithic implements. He thinks, however, that the Patagonian beds yielding palæolithic remains are more recent than the corresponding European formations, which would point at "a later industrial development of the Austral American aborigines."

In Section III., dealing with the New Stone Age, the author distinguishes three separate archæological periods, determined by the different forms of the

permanent stations, by the antiquity of the objects found in them, and by the different technical processes. These periods are fully described and profusely illustrated with reproductions of all kinds of objects—in the whole volume there are as many as 206 of such illustrations—and the author finds, in conclusion, many points of close contact between these Patagonian neolithic objects and those off other parts of America, as far north as British Colombia (scrapers, awls, pestles), and the hyper-borean Eskimo domain (scrapers, knives, darts, and arrows).

A. H. Keane.

GENERAL.

Lippincott's Gazetteer.

'Lippincott's New Gazetteer: A Complete Gazetteer or Geographical Dictionary of the World.' Edited by A. and L. Heilprin. London: J. B. Lippincott Co. 1906. *Price* 42*s. net.*

This well-known Gazetteer has once more been subjected to a thorough revision, making it the most up-to-date work of the kind now on the market. It is claimed that in its present form it is virtually a new work, the older edition having been used merely as the framework for the new. As far as can be judged from a few preliminary tests, the revision certainly appears to have been carried out with care and thoroughness. Thus under the heading "Chad" we find due record of the fact established by Lenfant, that an intermittent connection exists between its basin and the Benue; while under "Bali" we are correctly informed of the depth of the Bali-Lombok channel as determined by the Dutch *Siboga* expedition. The treatment of newly developed regions such as the Yukon or Rhodesia is satisfactory, while the statistics for the older countries seem equally up-to-date. The method of defining pronunciation cannot, however, be pronounced satisfactory, and no attempt seems to have been made to bring it into line with other modern systems of geographical spelling. In spite of the large (perhaps unnecessarily large *) number of special signs employed, various sounds which to a critical ear are really distinct, are not discriminated. Thus, though different signs are used for each of the vowel sounds in the words "berth," "birth" and "fur," it is thought unnecessary to distinguish between the sounds in berth and ravel, in "birth" and "evil," or in "fur" and "tub." No provision is made in the key for the sound of the second vowel in "ravine" (though *ee* seems to be used in the body of the work), while the use of *ĕĕ* (in addition to *e* and *ĭ*) for the sound in "pin," seems a perfectly gratuitous addition to the long list of signs. Again, the distinction between the three possible ways of sounding *ng* might with advantage have been made clearer. But the actual pronouncements on the subject seem generally correct, and, taken all round, the new edition is, like former ones, a distinctly valuable work of reference. It is clearly printed from new type, and the whole has most wisely been kept within the limits of a single volume.

Shell-currency.

'Muschelgeld Studien.' Verein für Erdkunde zu Dresden. 1905. Von Prof. Dr. Oskar Schneider, nach dem hinterlassenen Manuskript bearbeitet von Carl Ribbe. Dresden: 1905.

This interesting, but unfortunately incomplete, study traces the distribution, history, varieties, fabrication, and uses of shell-money throughout the world. In

* Symbols that might be needed to show the pronunciation, as is done in some dictionaries, without alteration of the current spelling, are of course superfluous when, as in the present case, the names are re spelt phonetically—a fact which seems to have escaped the editors.

Micronesia the distribution of this form of currency seems to have some ethnological importance, especially as regards the characteristic "gau" of the Carolines (*Spondylus* discs). Various forms are found in the Marshall islands, and were formerly in use in the Gilbert archipelago, but the occurrence in the Ladrones is doubtful. Many characteristic forms of shell-money are found in Melanesia, notably the "diwarra" or "tambu" of the Bismarck archipelago, "pele," "pig-money," etc. Examples are seen in New Guinea, but it is often difficult to distinguish between shell-money and shell-ornaments; and in the Fiji islands, where strings of shell discs have been collected, their use seems to be purely ornamental. It had always been a matter of surprise that a currency should have been evolved in Melanesia and yet be absent in the more cultured areas of Polynesia; so it is interesting to find that traces of shell-money have been cited from Samoa and the Hawaiian islands.

In Africa, as one would expect, the distribution is more general. The *Conus* shell-money is found principally on the West Coast, where the *Achatina* shell-money also occurs, ranging from Senegambia to Benguela. Chains of *Achatina* discs are seen, either as money or ornament, among the Bantu south of the Kuanza, and among the Shuli, Bari, Makaraka, Madi, Wassongora, Wakuma, Wawamba, Wawira, Wakonjo, and Lur.

The most important and widely spread form of shell-money is, of course, the cowry (*Cypræa*). The shells are common in many parts of the Pacific and Indian oceans, and probably were first used as currency in China and Japan. They were in general use in India; they are found in prehistoric graves in Europe, and had reached the West Coast of Africa in the fourteenth century.

Unfortunately, the record of shell-money in America consists only in a few notes and some admirable illustrations, and it is sincerely to be regretted that the author was not able to complete his careful and valuable study.

THE MONTHLY RECORD.

EUROPE.

The Scandinavian Main Water-parting.—In the *Norsk Geologisk Tidskrift*, vol. 1, No. 1 (Christiania, 1905), Dr. Hans Reusch points out a peculiarity in the main water-parting of the Scandinavian peninsula in that it does not run in irregular windings, but in regular scallops, concave towards the Atlantic ocean. The reason for this must be, in his opinion, that the rivers flowing in that direction have worked more powerfully than those flowing east and south, and have, therefore, pushed their basins eastward at the expense of the latter; the Glommen affording a striking example of a river of the eastern system whose upper basin has been encroached upon by its neighbours on the Atlantic side. The eastward shift of the divide is also proved by the occurrence of "hook-valleys," *i.e.* tributaries which unite with the main stream at an acute angle with the course of the latter below the junction, thus proving that they have been captured from an adjoining river-basin on the opposite side of the divide. Some small tributaries of the Rauma and Aura in the Romsdalen district are cited as instances, but the phenomenon is seen in various quarters, including the northernmost part of Norway, and, apparently, the Kola peninsula. The greater power of the western rivers may be due, not only to their steeper courses, but to the greater volume of water on the Oceanic side, while the action of the ice in the glacial epoch may have also contributed to bring about the said result.

The Tegern-See.—An interesting article in *Globus* (vol. 88, No. 23) traces the history of the Tegern-See in Bavaria from earliest geologic ages through human and political record down to modern times. In the environs of the lake there have been found no traces of prehistoric man, whether dwelling-places or graves, but only a few bronze hunting-weapons, lost, it may be conjectured, by hunters venturing into this district out of neighbouring inhabited regions. On the north side, at no great distance, grave mounds are found at Henfeld, Bruckmühle, and Aibling, in some spots on the right bank of the Mangfall, by Vallir, Gotzing, etc., all outside the lake region proper. Nor did the Romans approach nearer. There are remains of a Roman country house at Machtelfing on the Würm-See, of a villa on the Deixelfurt-See, a Roman entrenchment above Grünwald, military camps at Deisenhofen, but the Roman settlements selected the main arteries of intercourse, and the displaced pre-Roman population retired to the more distant regions. Not till the Bajuvar Germans, on the collapse of Roman rule, migrated, about the turn of the sixth century, into Rhætia and Noricum, was the Schlier and Tegern-See region gradually peopled and opened to human culture, and that only by slow stages. Whereas in some districts of the fruitful foreland places with the patriarchal "ing" ending, denoting the oldest Bavarian settlements, lie thick as meteoric clusters, only one, Scharling, has strayed into the Tegern-See region. Gotzing, to the north, belongs to the foreland. Both these places may be relegated to pre-Christian time. Place-names, on the other hand, in "reutin," "reden," "schwenden," or indicative of landscape and situations by woods, waters, etc., may, in view of the late settlement of the mountain region by Germans, be assigned to the Christian age. Of such places a long list is cited, such as Neurent, Gereuth, etc. Later on, when in the eighth century the Bavarian population was converted to Christianity, and monasteries and churches founded, the region advances into the light of history. In 756 a basilica and cloister were founded in the locality by Adalbert and Otkar. The cloister developed into an abbey, grew in wealth, and in the time of Duke Arnulf is said to have owned 11,000 hides, besides possessions in the Tyrol and Austria. In the twelfth century its abbots were imperial princes. But the record of the mediæval and later associations of the Tegern-See cannot be touched upon here.

ASIA.

Journeys in Central Asia.—Prof. Ellsworth Huntington lately passed through London on his return to America from the expedition to Central Asia, on which he set out in the company of Mr. R. L. Barrett early last year (*Journal*, vol. 25, p. 127; 26, 451; 27, 177). After separating from his companion at Keriya in the autumn of 1905, he started on a journey round the east side of the Lob Nor basin, which proved an adventurous one in some respects. The route led for four days over a vast salt plain, the surface of which resembled that of a frozen sea or petrified ploughed field, being formed of blocks of salt as hard as stone, into which the floor of an old lake-bed had broken. The caravan, consisting of four men with five camels, found the passage of this plain exhausting work. All this region was absolutely desert, and among its surface-features were miniature tablelands of clay rising abruptly from the plain like the "Mesas" of the arid region of North America. Intense cold was experienced, the average temperature being 2° below zero Fahr. during the whole march from Charklik to Tikkenlik, near the Tarim. At a point north of Lob Nor four of the camels were enticed away by wild companions, and it was only by the devotion and determination of one of the men that they were recovered, and a serious position retrieved. The further route led across the Kuruk Tag mountains to Karashar, important rectifications of existing maps being made, while a number of ruins were discovered along an old bed of the Tarim. After

a visit to the Turfan depression in the north-east, Prof. Huntington began his homeward journey. Another interesting journey across Central Asia has lately been made by Colonel Bruce, commanding the late Chinese regiment at Wei-hai-wei. Accompanied by Captain Layard and a native surveyor, he left Leh on August 29, 1905, and crossed Western Tibet and the Kuen Lun range to Keriya, whence he went north-east along the borders of the desert to Cherchen and Lob Nor. The route was continued eastward to the Kara Nor and Sachu, and thence across China to Peking, which was reached on May 6, 1906. It does not appear how far the route deviated from those of previous travellers, but it may be expected that additions have been made to our knowledge in respect of the less-known parts of the country traversed.

Journey from China to India.—We learn from the Calcutta *Englishman* of April 17 that a journey from Tongking and China to India has been made by a young English engineer, Mr. E. C. Young. Passing through Tongking in October last, the traveller entered China at Lao-Kai, and, following the line of the French Yunnan railway for some distance, made his way to Talifu. Frustrated in an endeavour to explore the right bank of the Salwin, he tried to cross the divide towards the Irawadi, north of 26°, but only succeeded on the third attempt, owing to the heavy snow on the passes. He crossed the Nmai-kha and, turning northwards, visited the Kamti Long district, crossing the other branch of the Irawadi, the Mali-kha, *en route*. After great difficulties, the mountains forming the divide between the Irawadi and Brahmaputra were crossed by the Chaukan pass, the route leading through dense uninhabited jungle to the basin of the Dihing, Sadiya being reached on April 9. The country traversed within the Irawadi basin is still little known, in spite of the journeys of Prince Henry of Orleans, General Woodthorpe, and others, so that further details will be awaited with interest.

The Sikhota Alin.—Between the years 1897 and 1901 Y. Edelstein made several excursions into this range, crossing it by five different passes (*Izvestiya* of the Russian Geogr. Soc., No. 2, 1905). Most of the summits rise to 2100 to 2800 feet above sea-level, and many are much lower; the highest, Khualaza, in the south Ussurian district, attains to 5152 feet. In consequence of this comparatively low elevation, these mountains nowhere rise into the region of eternal snow, though the climate is severe and precipitation abundant in winter; indeed, alps are not very common, the mountains being generally covered from base to summit with luxuriant primæval forest. Erosion has been very active, and torrents and rivers score the surface in every direction. The valleys are of two types. Those rivers which run entirely, or for the most part, through granites, schists, and sandstones, flow in winding valleys bordered by heights which, now on this side, now on that, approach the bed of the stream, breaking off in grand cliffs; while those which run through elevated volcanic plateaus have cañon-like valleys. Granites, of remarkably numerous varieties, are found at all elevations, and groups composed almost entirely of these rocks are not uncommon. They occur in all parts of the range, but are most frequent on its periphery, especially the eastern slope. They may have been thrown up near the sea to a greater height on the formation of the chain or in consequence of a rise in the coast. A thick layer of pebbles was noticed at a height of 260 feet near Cape Nicolas, resting on granite and covered with a thin sheet of basalt. Volcanic rocks cover a considerable area in the northern and central Sikhota Alin, both quartzite and felsite porphyries, diabase, etc., and more recent melaphyres, basalts, and dolerites. Crystalline schists and clay slates are also abundant, while limestones are rare.

AFRICA.

African Territorial Arrangements.—By an Order in Council, dated February 16 last, and published in the *Gazette* of the 20th of that month, the administration of Southern Nigeria has been placed under that of Lagos, the whole territory being henceforth known as the Colony of Southern Nigeria. The order was proclaimed in both sections of the territory on May 1, the day being celebrated at Lagos as a public holiday. Arrangements affecting the boundaries of Northern Nigeria have lately been come to in London with representatives of France and Germany as a result of the work of the recent mixed commissions. It is stated that a portion of the Zinder territory hitherto south of the international boundary, has been made over to France. The difficulties which had arisen between this country and the Congo State in respect of the Bahr el Ghazal territories have also been set at rest by an agreement signed in London on May 9, by which the lease of the Bahr el Ghazal to the Congo State, arranged for by the agreement of 1894, but which subsequent events prevented from taking effect, is definitely cancelled, except as regards the Lado enclave, which had always been on a different footing from the rest of the territory (*Journal*, vol. 4, p. 54). As a set-off, facilities are to be given to the State for the construction of a railway to Lado, with the establishment of a commercial port at the terminus; for the free navigation of the upper Nile; and the free transit of passengers and merchandize over the territories of the Egyptian Sudan.

Herr Frobenius' Researches in the Kasai Basin.—A second letter from Herr Leo Frobenius, describing the course of his ethnological expedition to the Southern Congo basin (*Journal*, vol. 26, p. 672), is printed in the *Zeitschrift* of the Berlin Geographical Society (1906, No. 2). In spite of some hindrances, the traveller had carried on fruitful researches, both ethnographical and geographical, in the region of the middle Kasai, a region first brought to light by the now classic labours of Germans like Pogge and Wissmann. He had been able to survey parts of the Kasai itself, in the section which includes the Pogge and Wissmann falls, that had hitherto been imperfectly known, and had brought to light a third imposing fall, which he named after his artist companion, Hans Martin Lemme. He reports that rapid changes are taking place in the character of the Pogge and Wissmann falls, the latter especially having been virtually destroyed since 1888, and become nothing but a heap of *debris*. Great changes have also taken place in the distribution of the population since Wissmann's time. Herr Frobenius dwells on the close relation which exists between the geographical and ethnographic situation, the physical division between the forest in the north and savannah in the south, constituted by the waterfall-line, having its ethnographic counterpart. Wave after wave of invasion has passed from south to north, and the older culture of the Baluba is even at the present day being overwhelmed by the movement of the Kiokwe from the south, which forms a striking instance of the replacement of an old and effete race by a young and vigorous one.

Coast-ledges in Cape Colony.—The subject of the shelves or ledges on the margins of the continents has been much discussed of late, and a contribution to the body of facts that has been accumulating is made in the *Quarterly Journal of the Geological Society* (February number, 1906), by Prof. E. H. L. Schwarz, to whom we owe many recent additions to our knowledge of the physical geography of South Africa. Prof. Schwarz describes some remarkable platforms which fringe the southern coast of Cape Colony, all of which he attributes to marine denudation, though, with the exception of the well-known Agulhas bank, most are now elevated above sea-level. The most striking of the coastal plateaux

is that extending from Caledon to Port Elizabeth at an elevation varying between 600 and 800 feet above the sea. In the west of this area the plateau form is to some extent obscured by the result of erosion, which has furrowed the surface with a labyrinth of steep-sided gorges, with narrow intervening ridges ("ruggens" of the Dutch). But it can be plainly seen that all the ridge-tops are cut to a level which slopes gently to the sea. East of Georgetown the plateau-form becomes much more prominent, the Table-mountain sandstone or granite of which it is composed having been far more resistant than the clay-slates further west. Some have considered this coastal plateau to be a peneplain or base-level of river-erosion, but Prof. Schwarz is confident that it is a plain of marine denudation. He shows that there are other more or less extensive ledges, admittedly surf-cut, at various levels above and below tide-mark along this part of the coast, while further east coast-shelves occur as far as the native territories. At East London there is a remarkable succession of plateaux, each terminating in an abrupt drop, at altitudes varying from 151 to 5450 feet above the sea. In comparing the facts observed in South Africa with those in other parts of the world, the writer introduces a term which will perhaps be objected to by some, viz. "absolute base-level of erosion," by which he intends the extreme limit to which the action of running water has ever made itself felt during the oscillations subsequent to the time when the continents practically assumed their present outline. Such a term is, no doubt, useful as expressing a datum from which to reckon the extent of subsequent oscillations, but the difficulties in the way of its determination must be very great. Prof. Schwarz (who by running water seems to include waves and currents) places it at the base of the steep slope leading from the continental shelf to the ocean floor, and considers that on the European coasts of the Atlantic it is now 9000 feet below sea-level; on the American side, 12,000 feet; while in South Africa it stands at 1200. This shows, he thinks, that while the Atlantic coasts of Europe and America have very nearly reached bottom on the down grade of oscillatory motion, South Africa is on the up-grade and nearly at the top, the far greater maturity in the topography of Europe as compared with South Africa being in harmony with these suppositions. This relation, no doubt, holds good, but that erosion has been effective in recent geologic time to depths of 12,000 feet will hardly be considered as fully established.

Prof. Penck on South Africa.—A summary sketch of the broad characteristics of South Africa, as seen by him from the point of view of physical geography during the visit of the British Association, was given by Prof. Penck in the Vienna Journal *Die Zeit* of April 6, a copy of which we have received from our correspondent, Dr. Peucker. Prof. Penck's observations were, broadly speaking, limited to the wide zone which forms the southern and eastern border of the interior plateau, in northern Cape Colony, the late Boer territories, and Mashonaland. His remarks do not, therefore, apply to the coast-lands between this zone and the sea. He dwells especially on the varying character of the elevations according to the geological structure, distinguishing between the steep-sided table mountains (*Kranzberge*) largely composed of sandstone; the peaked summits (*Spitzberge*) formed by the laying bare of the lava-sheets; the kopjes of further north, often associated with quartzites; and the granite bosses of the Matoppos. A general characteristic, however, is the isolated nature of the mountains or groups of mountains, which greatly facilitates communication throughout the country by the passages always left open between. The whole country is marked by the vast extent of the denudation to which it has been subject, the action of running water or wind having during countless ages removed all but the hardest portions, which now stand out like islands above

the general surface. Referring to the Victoria falls, to the neighbourhood of which Prof. Penck devoted a week of careful study, he fully bears out the views of Mr. Molyneux (*Journal*, vol. 25, p. 40) as to their origin and the causes of the zigzags in the course of the river below. He lays stress on the youthful character of the Zambezi in this region, contrasting the falls with those of the streams in Natal, which have widened their valleys both above and below the obstruction to which the falls are due. He considers that before the present state of things set in the climate must have been drier than at present.

Northern Nigeria.—A Colonial Report (Annual, No. 476) by Sir F. Lugard, on Northern Nigeria, tells of a distressing famine affecting large districts of the protectorate, more particularly Yola and Bauchi, during 1904, involving the sale by famine-stricken parents of their children in large numbers, and leaving many of the people without either corn for the sowing of 1905 or strength enough for the tillage of their fields. Of unusual length, the report is of especial value for its notes on all the provinces, embodying accounts compiled by the respective residents in charge, and observations made by Sir F. Lugard personally during his tour of inspections in 1904, a tour covering a distance of over 2000 miles by land, and over 1600 miles by water, including every province except Sokoto. The report thus supplies a sketch of the history of each province from early times, its present state, social organization, area, configuration, character of soil, climate, products, resources, population, trade, industry, administration, policy, outlook; in short, data of exceptional value for an accurate and comprehensive appreciation of the factors involved in its development. The report comprises, also, an account, from the forestry officer, of the forestry and agriculture of Northern Nigeria.

AMERICA.

The Delta of the Colorado.—An interesting description of the still imperfectly known delta of the Colorado, under its various aspects is given by Mr. D. T. Macdougal in the *Bulletin* of the American Geographical Society (New York, No. 1, 1906). The writer was member of an expedition which traversed the delta in 1905, and had paid more than one previous visit in company with Mr. Godfrey Sykes, who has made several independent voyages through the estuary to the Gulf of California, and supplies a sketch-map in illustration of the paper. As a rule, the river runs at a low stage for three-fourths of the year, but with the melting of the snows in May begins to rise, until in June and July the delta is practically submerged. Last year the writer was witness of one of the exceptional floods which occur at long intervals earlier in the year, and cause serious disturbances to all life in the delta. The course of the stream at the present day differs widely from that shown by Ives and other surveyors of the middle of last century, as its cutting action is rapid and continuous at various points on the edge of the Sonora desert on the east. At these points a striking contrast is to be noticed between the swamp vegetation of the water's edge and the xerophytic forms of the desert, for, contrary to what is often stated, the river has practically no power to modify the desert climate of the surrounding region. Within 50 feet of the water, a relative humidity as low as 17 per cent. is often recorded. Last year's expedition verified the existence of a flood waterway which leaves the main stream above tide water, and flows south-easterly into the Santa Clara at the head of the Gulf of California. It formed a navigable stream which might easily become the main channel. Solid land seems to be extending its area at the mouth of the river, where the present Hilda island was noted for the first time in 1890. Islands have appeared and disappeared in a very capricious fashion, the bore, which rushes up the funnel-shaped mouth with great violence, causing great changes. A

considerable portion of the flood water never reaches the sea, but finds its way into the old Salton lake depression to the north-west. The flood of 1905 poured enough water into this to form a lake of 600 square miles, and as the intake is facilitated by irrigation operations, the re-appearance of a permanent lake is not impossible. Another basin below sea-level, west of the Cucopa mountains, is fed by the Hardy, the western branch of the delta, and at the highest floods these mountains are almost surrounded by water. It is, therefore, not surprising they contain many endemic species of animals and plants, while, as the area watered by the river is surrounded on all sides by desert or salt water, it forms in reality a biological island. The Cucopa Indians who inhabit the delta are a dwindling remnant, waging a losing fight against adverse conditions, but with the initiation of civilized methods of irrigation, the rich alluvial lands may become the home of many thousands.

The Geology of Orizaba.—A short paper by E. Angermann, printed in the *Memorias* of the Sociedad Cientifica "Antonio Alzate" (vol. 21, pp. 365–369), describes geological observations made during an ascent of Citlaltepetl, or Orizaba. The base of the mountain rises in steps, indicating the succession of the various phases of eruption to which it owes its origin, but its form has since been modified by erosion. The beautiful conical summit, composed of a compact and hard andesite (amphibolite), seems to be taking more and more, under the agency of erosion, the form of a triangular pyramid. It is difficult to decide whether it rises from an ancient crater; but in any case the Sierra Negra is not such, but represents an independent volcano with its own crater. There seem, however, to be traces of an ancient crater on the east side and elsewhere. The volcanic cones to the north-west of San Andrés Chalchicomula seem to be parasitic in character. The present crater—a deep gulf several hundred feet deep, oval in section above, and with a major axis of little over 300 yards—bears no resemblance to the typical funnel-shaped crater. The author considers the volcano to belong to the monogenic type of Stübel, and to owe its origin to a single eruption of long duration. He does not believe that it rises from a line of weakness of the crust, as might be supposed from its position at the edge of the Mesa Central, apparently bounded coastwise by a line of subsidence. The actual ascent of the mountain, which gives a wonderful insight into the geological structure of the district, negatives this view, and shows that the rampart of the Mesa Central is piled up by the volcanic products of the great mountain. The varying colours of the different formations are taken in at a glance, and the true relations of the latter thus made manifest. The height obtained by aneroid was 18,045 feet, which would seem to be too low a figure, previous more precise determinations having given results between 18,179 and 18,312 feet (cf. *Proc. R.G.S.*, vol. 14, p. 804).

Structural Lines of South America: Rocks at the Madeira Cataracts.—In a paper on the rocks of the cataracts of the Madeira, printed in the *Quarterly Journal of the Geological Society* (vol. 62, part i.), Dr. J. W. Evans begins by discussing the general configuration of the region, and brings together from all available sources such data as throw light on the main directions of the structural lines. He shows that the crystalline rocks, to which the falls of the Madeira and neighbouring streams are due, seem to belong to an important axis of folding and elevation, with a south-east and north-west direction, which apparently extend for 1200 miles—from 14½° S., 59 W. to 4° S., 73° W., near Iquitos, on the Amazon. This direction, parallel to that of the Andes in Northern Bolivia and Southern Peru, seems to prevail also in Southern Venezuela, Guiana, and North-Eastern Brazil, and coincides with the direction of strike so common on the Earth's surface for some distance on either side of the equator, and which seems closely connected with the

causes of the easterly position of the land-masses in the southern hemisphere as compared with those in the northern. It occurs again in the south of the continent, and forms one of the four principal directions of folding or elevation in South America, the other three being—(2) a direction roughly at right angles to the first, seen on the coast of Brazil south of Cape San Roque; (3) an east-and-west strike, seen in Northern Venezuela and the Amazon basin; (4) the north-to-south line of the Southern Andes. With regard to the rocks which form the special subject of the paper, Dr. Evans summarizes the results of his observations as follows: With the exception of comparatively recent alluvial deposits and a few pebbles of chert of marine origin but uncertain date, only crystalline rocks are met with. They all appear to be igneous, mostly massive in character, though some dyke-rocks occur. In places they are typical gneisses, and they are often banded; but in some cases they show no signs of foliation. The black coating found on the rocks of the Madeira cataracts, as on those of so many others within the warmer regions of the Earth (cf. *Journal*, vol. 20, p. 655; vol. 27, p. 197), is briefly discussed. An analysis of a small quantity of material scraped from the rock has shown that, as elsewhere, oxides of manganese and iron from the great bulk of the soluble constituents, the former (54·1 per cent. of the whole) being probably a variety of psilomelane (hydrated manganese oxide). Unlike Mr. Lucas (*Journal*, vol. 27, p. 197), Dr. Evans thinks the film derived form the water, not the rock, saying that he has found large crystals of quartz and felspar coated equally with biotites or hornblendes, while he has also seen crags of white sandstone covered with a jet-black coating, which caused them to resemble basalt. He thinks that manganese and iron oxides are more soluble in river-water in the tropics than in colder climates, but that possibly organic compounds dissolved in the water play a part as well as the higher temperature.

AUSTRALASIA AND PACIFIC ISLANDS.

Exploration in Central Australia.—The journal of two exploring expeditions by the Central Australian Exploration Syndicate, under the leadership of Allan C. Davidson, is published by the South Australian Government as a parliamentary paper (A., No. 27, 1905). The region proper explored measures 11,000 square miles in the northern territory of South Australia, held by the syndicate under special permit from the South Australian Government, between 19° and 22° S., or extending from Barrow creek to Attack creek, a length of 220 miles. Lying east of 134° E., the bulk of the region is also east of the Overland Telegraph Line. Its greatest width, on lat. 20° 50′ S., is 80 miles. The first expedition, to the east of the Telegraph Line, occupied two years, 1898–1900. The second expedition, to the west of the Telegraph Line, started from Kelly's Well, May 5, 1900, and reached Barrow creek September 20, 1900, thus consuming four and a half months. Of the region to the east of the Telegraph Line, occupied almost entirely by the Murchison and Davenport ranges, and containing splendid gorges and some permanent springs, only a small proportion was found metalliferous, and these metalliferous belts, with one exception, were very small. In them were found many gold-bearing reefs, but of so low grade as not to justify the outlay required to develop them. Only with the extension of the railway line from Oodnadata to Port Darwin would the mineral resources of the country suffice to induce the human development of that region. With an elevation of over 2000 feet, the country is well adapted for permanent settlement. Water is abundant, and in the many valleys and plains there is good grazing-land. The region is, moreover, plentifully timbered with gums and other woods. The western expedition, which made more than 200 miles westwards

without encountering any permanent water, and, entering West Australia, reached 128° 58′ E. and 20° 6′ S., travelled 1370 miles direct, or, including the extra walking involved in such prospecting operations, 2200 miles. The area of country traversed, and that proved indirectly to be desert or of no mineralogical value, measured 30,000 square miles, including 4000 square miles of metalliferous belts of granite, eruptive and metamorphic rock, 6000 square miles of sandstone and quartzite ranges, with conglomerates and desert sandstone, and 20,000 square miles of Recent and Tertiary formations, consisting of alluvial plains with sandhills, gravel, travertine, limestone, and conglomerates. In the way of pasture, there is a splendidly grassed country in one block of 500 square miles. Two maps show, one the geographical features and geology of the country traversed, the other the belts of gold-bearing country and the work of the first two years. Altogether, the two expeditions, covering 27,000 square miles, yield a very material contribution to the topography and geology of a space hitherto blank in the map of Australia.

British New Guinea.—The annual report for the year ending June 30, 1904 (Commonwealth of Australia, No. 1, C. 7001, 1905), contains less than some former reports of strictly geographical matter, though some of the visits of inspection made by the late acting administrator, Mr. Christopher Robinson, were of interest from this point of view. Such was an expedition carried out under the guidance of Mr. Monckton, resident magistrate of the north-eastern division, with a view to testing the feasibility of a road from Ketakeura bay to the Yodda valley goldfield. The party wandered for fifteen days through an extremely difficult mountainous country, inhabited by hostile natives, finally emerging at Papangi Government station, fully convinced of the impracticability of a road by the route followed. Subsequently, a surveyor with a quantity of stores was landed at Buna bay to start the making of a road from this point to the Yodda valley. A visit was also paid to an inland lake, situated in moderately flat country between the Mambare and Opi rivers, an interesting feature in which is its depth, ranging from 36 feet immediately under the bank, to 168 feet in the centre, though the area is only about 3000 acres. A tribe named Siagara has here taken refuge from the attacks of stronger neighbours, in houses built on rafts. During visits of inspection in the western division, the administrator was accompanied by Dr. Seligmann and other members of the Daniels Ethnological Expedition, some results of which were outlined in the *Journal* for April. The report discusses the present position and outlook in each of the administrative divisions in turn. The central division, although comprising the earliest settled parts of the possession, includes a coast tract between the Purari and Cape Blackwood, which has not yet been fully brought under Government influence. Port Moresby has been temporarily eclipsed by Samarai, the headquarters and port of entry for the eastern division, owing to the discoveries of minerals in the east and north-east; but as agricultural development progresses, prosperity will probably return to the former. The mountains have only here and there been prospected for minerals, but there is no reason for supposing the south side of the range to be less rich than the north. The hopes formed a few years ago that Murua, or Woodlark island, the headquarters of the south-eastern division, would become a rich gold-producing island, have not yet been realized, but deep sinking has given indications of better things. The excessive death rate among native employés, which is one of the greatest obstacles in the northern division, does not obtain here. In the north-eastern division (where no mining is at present being done) the progress in native administration is reported as wholly satisfactory. In the northern division, the road already alluded to was cut in great part by the rawest of wild savages, whose confidence

was gained by the authorities, and who gave most valuable help. Owing to difficulties with the hill tribes, the station at Papangi was removed to Kokoda, in most respects a better situation, and, it is hoped, a more or less healthy one, owing to its altitude of 1000 feet. It was proposed to transfer the other station from its unhealthy site at Tamata to some hills higher up the creek. The western division, in all respects a totally different world to the rest of the possession, has not yet attracted settlers, but an immense tract of country within it is probably well adapted to sugar-cultivation.

POLAR REGIONS.

Mr. A. H. Harrison's Expedition.—Under date March 1, Mr. Harrison writes from on board the steam-whaler *Jeannette*, at Herschel island, near the mouth of the Mackenzie, giving a brief account of his experiences down to the time of writing (cf. *Journal*, vol. 26, p. 561). Leaving Athabasca landing on July 22, in a boat specially built to transport his supplies, he reached the Arctic Red river (a western tributary of the lower Mackenzie) on October 4, but was then stopped by ice. On the way he took many observations for latitude and variation. During the winter he made a short route-survey, with perambulator, prismatic compass and sextant, of the winter trail from Red river to the Peel, down the latter from Fort McPherson to its mouth, and up the Mackenzie to the Red river. Observations for latitude and variation were also made at various points. During the winter, which was a very early one, with exceptionally deep snow, temperatures of 68° below zero Fahr. occurred. In order to avoid the risk of losing a year, Mr. Harrison left his goods behind, and went on to Herschel island in February, finding Lieut. Hansen and the members of the *Gjöa* expedition, except the leader, who had gone to Eagle city. He met with every kindness from them, as also from the captains of the whalers which had been caught by the early winter. As to his further movements, he feared it would be impossible to go north upon the ice, which round Herschel island is only floe-ice, constantly shifting with the wind. Nor was it possible to get natives to go north, in which direction, however, he is confident that land exists. From the whaling captains he gathered much information as to the movement of the ice, which seems to follow no definite law. Various ships have been carried away by the drift and not seen again, while of a number of buoys, put down by the captains for some years past, none have ever been heard of, and Mr. Harrison concludes that they have drifted on to land in the unknown area. The drift seems entirely governed by the winds.* Mr. Harrison hoped to make his way in April to Baillie island, and thence to Banks Land, where he proposes spending next winter.

Mr. Wellman's Air-ship Project.—Mr. Walter Wellman, who, in 1898, made an unsuccessful attempt to advance to the pole by the Franz Josef Land route, has formed the project of reaching that goal by means of an air-ship, and is now organizing an expedition, financed by Mr. Victor Lawson, principal owner of the *Chicago-Record Herald*. From an article on the expedition in the April number of the *National Geographic Magazine* we obtain the following information:—"No expense is being spared to secure the greatest possible chance of success. After consulting with the foremost experts in Paris, Mr. Wellman gave the contract for the air-ship to M. Louis Godard, whose experience as a constructor of such vessels is unique. It is to be of a size sufficient to enable it to lift, not only the balloon, but the car of steel, three motors with an aggregate of eighty

* It is usually considered that a general drift to the east sets along the north coast of Alaska (see Harris, in *Nat. Geog. Mag.*, 1904, pp. 255-261).

horse-power, two screws, a steel boat, motor sledges, five men, with food for seventy-five days, all necessary tools and appliances, and 5500 lbs. of gasoline. The gas-bag is made of the most carefully selected fabric, consisting, in the central zone of greatest pressure, of three layers of materials (two of cotton and one of silk), with three coats of rubber, the coefficient of safety throughout being calculated as over five to one. The outer surface is quite smooth, with no netting to hold moisture, snow, or frost, additional power of resistance being supplied by double bands of fabric cemented over the seams internally. The steel car is 52½ feet long, the central section being provided with walls and roof of water- and fire-proof fabric, the roof being 78½ inches above the floor. The motors should give, apart from the influence of winds, a speed of 17 geographical miles an hour, and Mr. Wellman reckons, from a careful study of the winds of the Arctic, that this should enable him to cope with over four-fifths of all that are likely to be encountered in July and August. When opposed by stronger winds, it is proposed to drift with them, the loss of ground being in part neutralized with the help of a dragging anchor, so that, as *all* the value of favourable winds will be utilized, more help than hindrance may be anticipated from the effect of winds as a whole. The expedition has the support of the National Geographic Society, and will be accompanied, as scientific representative of that body, by Major H. B. Hersey. The steamer *Frithjof*, already used more than once in connection with polar exploration, has been chartered for the seasons of 1906 and 1907, and will, it is hoped, sail from Tromsoe for Spitsbergen about June 20, headquarters being established at Low island, in lat. 80° 20′. Should all seem favourable, an attempt to reach the pole will be made this year, otherwise it will be postponed till 1907. The length of the whole trip by the air-ship is reckoned at ten days, but it is thought that it can be kept in the air as long as twenty, or possibly twenty-five, days. Mr. Wellman hopes to keep up communication with the outside world by means of wireless telegraphy, stations being established at the headquarters in Spitsbergen, and at Hammerfest, in Norway. We understand Mr. Wellman will take with him 2000 fathoms of sounding wire in the hope of getting soundings at one or two points.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Physical History of the Earth.—In the February number of the *Geological Magazine*, Mr. T. Mellard Reade points out the modifications which the discovery of radio-active materials may necessitate in our ideas respecting the past history of the Earth. Thus, as the rate of cooling of the latter must be slower than has been supposed in proportion to the quantity of heat generated by the radio-active matter present, the radial shrinkage will also be reduced, and the mountain-making activities on the contraction hypothesis rendered less efficient. Those who, like himself, have held in the past that the gradual dissipation of the initial heat of the Earth, considered simply as a cooling body, is insufficient to provide the radial contraction necessary to explain existing phenomena, will thus find new support for their contention, for if any of the lost heat is renewed, the insufficiency is proportionately intensified.

The Possible Thickness of an Ice-cap.—This subject is briefly discussed by Prof. E. H. L. Schwarz, in the light of recent research, in the March number of the *Geological Magazine* (Decade 5, vol. 3, No. 3). The writer points out that the view of the physicists that no column of ice could exist on the Earth's surface of a greater height than 1400 to 1600 feet is borne out by actual observations, especially those of Captain Scott in the Antarctic. In no case where there has been direct measurement has the ice been found to exist in sheets surpassing the 1600-feet limit, while the ratio between the portions of an iceberg below and above

water has been shown to be frequently much below the theoretic amount. It is only if the surface of the ground on which the ice-cap rests is below the temperature of the melting-point of ice that a thickness of over 1600 feet is possible, and, in view of the protection against radiation from the Earth afforded by an ice-cap, it is unlikely that this condition can be fulfilled. Drygalski's observations in Greenland have shown the rapid and regular rise in temperature which occurs in an ice-sheet from above downwards, the heating effect of pressure being a contributory cause. Mr. Schwarz holds that at a time of maximum glaciation (which is one of less intense cold), the running water beneath the ice will have had a powerful effect in deepening valleys, so that it is not safe to conclude, as is sometimes done, that ice once filled such valleys from their present bottoms to the highest levels at which ice-scorings are traceable on their sides.

GENERAL.

Prof. Penck's Successor.—Edward Brückner, Professor of Geography in Halle University, has been called to the chair of physical geography in Vienna University, in succession to Prof. Penck. Son of Alexander Brückner, Professor of History in Dorpat University, Edward Brückner was born in Jena, July 29, 1862. Only a few years younger than Penck, he is distinguished as his oldest disciple. As shown by his first important work, 'Die Vergletscherung des Salzachgebietes' (1886), and the work 'Die Alpen im Eiszeitalter' (1901–03), published in joint authorship with Penck, he has continued his faithful co-worker in the field of glacial research. He made himself a name by his 'Klimaschwankungen seit 1700,' published in 1890. In this, as in his hydrological works, he approved himself a scientific investigator of independent power. More widely known are his works, written with great perspicuity, 'Die feste Erdrind und ihre Formen' (1897) and 'Die Schweizerische Landschaft einst und jetzt' (1900). The first professional chair he held was in the Confederate University in Berne. In 1904 he succeeded Prof. Alfred Kirchhoff in Halle.

The Monaco Oceanographic Institute and Museum.—It is announced that the Prince of Monaco has decided to transfer to Paris the Oceanographic Institute founded by him at Monaco, and has set apart the munificent sum of £160,000 for its maintenance, besides endowing it with the museum established by him, and all the scientific appliances connected with it. The management of the institute, which will be placed on ground acquired, with the Prince's aid, by the University of Paris, will be vested in an international committee of specialists.

OBITUARY.

General Sir H. E. L. Thuillier, Kt., C.S.I., F.R.S.

On May 6 there passed away peacefully, at the ripe old age of ninety-three, Sir Henry Edward Landor Thuillier, Kt., C.S.I., F.R.S., the oldest survivor of the Hon. East India Company's Artillery, and one of the best known of the long line of scientific gentlemen who, as surveyors-general of India, have directed the progress and shaped the ends of map-making in that country until there is little left to discuss but the revision of out-of-date surveys and the exploration of trans-frontier regions. For thirty-one years (from 1847 to 1878) he held that responsible post ere he retired to become a useful member of the Royal Geographical Society's Council, and a friendly adviser to all who meditated geographical enterprise. To cast back to a date ten years before the Mutiny, and to describe

the position of the Indian surveys or of Asiatic geography at that time, would be an interesting analysis of scientific progress, but it would be a lengthy one. Half of India was then unknown. The plains of the Punjab (not fully wrested from the hands of the Sikhs) were as fair a blank in our maps as the basin of the Godavari or the forests of Southern India. Colonel Thuillier saw the great network of geodetic triangulation grow and spread over the length and breadth of the peninsula until it formed a well-ordered system of earth-measurement which was certainly the most exact in its day that existed in the world. Under his guiding hand men such as Walker, Basevi, Montgomerie, Tanner, Woodthorpe, and Harman (who with many others have passed from the scene of their labours before him) made their names famous as scientists and explorers, carrying their lives in their hands and their instruments and observations to the farthest peaks of the mountain border-land. Half a century of progressive Indian history is bound up with the life-work of such a man as Sir Henry Thuillier; and of all half-centuries that have ever been since India first marked its beginnings as a part of the British Empire, it is surely the most stirring and the fullest of civilized progress. Few figures were better known in Calcutta and Simla than his, and no man was better respected or more loved by his many friends. Genial and kindly, helpful and hospitable, he was typical of a phase of Anglo-Indian society which is rapidly disappearing. Times have changed; and he fitted to his times with the traditional sympathy and good fellowship which are only associated with intercourse between pilgrims in a foreign land when that land is new and strange. Sir Henry Thuillier belonged to an administrative phase that is past, and he was one of its worthiest and best representatives. His name will last in the social and scientific annals of India's growth when that of many a more magnificent administrator will be dead and forgotten.

T. H. H.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1905–1906.

Eleventh Meeting, April 9, 1906.—The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., F.R.S., President, in the Chair.

Presentation of the American Geographical Society's Medal to Captain R. F. Scott, R.N.

The President: The first business on the agenda paper to-night is the presentation by His Excellency the American Ambassador of the Gold Medal of the American Geographical Society to Captain Scott, R.N., commander of the National Antarctic Expedition. For several reasons this ceremony has an especial interest to the Royal Geographical Society, which has been so intimately connected with the enterprise which Captain Scott commanded. In the first place, as geographers, we recognize that the American Geographical Society is exceptionally qualified to gauge and appreciate the splendid qualities, moral, mental, physical, which enabled Captain Scott to carry his arduous enterprise to so successful a conclusion. And I say the American Society is especially qualified, because for the last sixty years or more the United States have taken a leading part in polar exploration. In the Antarctic Regions, which Captain Scott has come back from, their interests arose from having a preponderance of whalers in the southern seas, and there is one American name, that of Commander Wilkes, which stands out prominently in the same plane as that of his famous British contemporary, Sir James Ross. In the Arctic Regions the name of their

explorers is legion. As I must be very short in my introductory remarks, I can only pick out a few of the more celebrated names. As you may remember, the United States first engaged in Arctic work out of sympathy with the Franklin Expedition, which had been lost. It was a cause of pure philanthropy; they have carried it on since as a cause of idealism. There were the Grinnell expeditions, which lasted from 1850 to 1855, associated with the name of Dr. Kane. There was Dr. Hayes' expedition, which also went up Smith's sound. Then came Captain Hall, who, during ten years, led several successful expeditions. Then there was Lieut., now General, Greely; he is still alive. Perhaps the most famous of American Arctic explorers is Commander Peary. He is at the present moment engaged in an attempt to reach the north pole, in which we all trust he will succeed. I think I have justified the statement that an American Geographical Society is especially qualified to understand the value of Captain Scott's work. But we have a second ground of satisfaction to-night of an entirely different order. In our Society, besides being geographers we are also Englishmen, or perhaps it would be safer for me, in view of certain faces that I see here, to say Britons; and, as such, we value every expression of sympathy and understanding that comes to us from across the Atlantic. I think you would not wish me to sit down without a brief reference to a third and very strong ground of satisfaction in the ceremony to-night—I refer to the compliment implied in the channel through which this medal is about to reach Captain Scott. His Excellency the American Ambassador is the latest but not the least of that remarkable series of men, eminent in culture, in intellect, in ability, whom the wise policy of the United States has sent to the Court of St. James as ambassadors. Long may that high standard be maintained! And we cannot doubt that Captain Scott will appreciate this medal of the American Geographical Society all the more highly because it reaches him through the hands of Mr. Whitelaw Reid.

H. E. the Hon. Whitelaw Reid (American Ambassador): Under the authority of my Government, and at the request of the American Geographical Society, I am here to-night to bring an expression of the high esteem in which the recent Antarctic work done by one of your young naval officers is held in the United States. Our people have never been unobservant or unappreciative of your great achievements in polar research. The very first Arctic exploring expedition ever sent out, I believe, was sent from these shores. It is interesting to remember to-night, as you have already reminded us, that three hundred years later the first Arctic exploring expedition sent out from the United States—the first, at least, of any importance—was organized by a merchant prince of New York to join in the general search then in progress for an English expedition which had not been heard from, and which never returned—that led by the lamented Sir John Franklin. It is interesting, too, to recall that when that long search of thirty years and more was ended, and the tragic fate of that expedition was finally ascertained, it was to a young American naval officer, Lieut. Schwatka, who was born in the same little Illinois town identified with General Grant—it was to that young naval officer, Lieut. Schwatka, that the frozen north gave up its long-kept secret. If I venture, following the precedent you have been good enough to set me—if I venture to mention the names of some other Americans not altogether unknown in polar exploration, names such as Kane, Wilkes, Hayes, Hall, Greely, Peary—if I mention these names, it is only for a reason which you have also already suggested: they show that those who have awarded the distinction which I have the honour to bring here to-night to the most recent of your explorers were by no means inexperienced or incompetent judges. The American Geographical Society and the American people have noted with interest and with admiration the work done by

your recent National Expedition, which spent two years and a half inside the Antarctic circle, which went within 7° and some minutes of the south pole, which was so skilfully and prudently led that during all those years of exposure and hardship it only lost two men, and which came back with larger additions to our knowledge of that least-known portion of the globe than had ever been brought before by any expedition from any country. Those whom I represent would not be the young and daring people they are if they did not find especial pleasure in the fact that this expedition was led by a man who had barely attained thirty years of age when he was assigned to the command, and that the majority of the force he conducted to such brilliant success was likewise composed of young men. Those I represent here would not be the Americans they are if they did not likewise take an especial pleasure in the fact that this work by these brave young men on this side of the water under these difficulties was done by Englishmen. The pleasure which they would have felt if they had done it themselves is the only pleasure they could feel greater than they experience now in seeing that you have done it. The official letter which I hold in my hand advises me that the American Geographical Society, at its last annual meeting, voted unanimously its highest award for scientific work, the Cullum Geographical Medal, to Captain Robert F. Scott, R.N., for the voyage of the ship *Discovery*, and for his sledge journey to lat. 82° 17′ S., 1901–4. In their name, Captain Scott, I now have the honour to present to you this Gold Medal, suitably inscribed, as an authoritative and most cordial American recognition of your high services to science.

Mr. Whitelaw Reid then presented the medal.

Captain Scott: I find it most difficult to express my appreciation of the extraordinary honour which is done me to-night by the American Geographical Society, or to express my appreciation of the manner in which that honour is enhanced by the fact that His Excellency, the representative of that great country, should have given this medal into my hands. In fact, I may say that with the awards and honours that have come from America my cup is brimming over, because this is the second time an American Geographical Society has awarded me a medal, and it is the second time it has been presented by the representative of the nation. I feel we must all consider the generous spirit in which it is given, and feel the greatness of the tribute which has been paid to a British explorer. But I, for myself, must also feel that the reward far exceeds the merit of the service. I think, perhaps, my first thought to-night is that this occasion provides the most excellent answer to a class of individual who bothers me greatly. It is the class of man who approaches me, and I am sorry to say he is very common; and he asks, After all, what was the good of it all, what was the use of it? Well, such a person as that, having a material mind, must have a material answer, and here it seems I am provided with the answer, because I can say now, "I have received two gold medals from America." Up to the present I have tried him with other methods. I have said to him, "The interest has been great to a number of English scientific men and English geographers." But I am sorry to say, I am sorry to speak it in this company, that he still remains doubtful as to the value of the service, because he regards us rather, I am afraid, as amiable but misguided enthusiasts. But, however, in future I shall be able to throw the United States at his head. I should commence, I think, perhaps by quoting some words of Emerson, which may or may not be remembered, and possibly I may not remember them correctly myself. But Emerson, speaking of Antarctic expeditions, wrote, "It is to the interests of all that these expeditions should take place, and a state or an individual who studies true economy will forget its frugality in behalf of claims

such as these." I do not know that I am word-perfect, but I know that that is the gist of his statement. It is a good thing to start with a statement such as that, but though I have been rather anticipated, I think I should go on to quote those deeds of American explorers, those names which are ever illustrious in polar exploration—of Kane, of De Long, of Hall, and last, but not least, of that great explorer, Peary, who is now absent, and whom we all wish success on his present mission. But, sir, I think such an occasion as this must supply to us something more than an answer to this material and ignorant person who is so largely in the majority of not knowing the uses of polar exploration. It supplies to us, I hope, some thought that polar exploration in a way helps those ties which join nations together apart from all political rivalry. Science, in working for the common end, brings the scientific men of all nations and of all times together in the pursuit of natural knowledge; and it seems to me that polar exploration, as a field from which political consideration must be altogether banished, plays no small part in forging that bond which we must all wish to see strengthened.

I have spoken so far of the past, and there seems to me some words left to be said of the future of polar exploration. I am sorry to say that my lines are cast in such places that in all probability I shall not myself return to those regions —regions where there is a fascination which is hardly to be explained to those who have not visited them. Sometimes now, caught up in the whirl of this modern life, and with my activities chained to new interests, my thoughts go back to those past times, and I see again those fields of snow sparkling in the sun; I see the pack-ice and the bergs dotted over the blue sea, and I see those mountains, those glorious southern mountains, rearing their heads in desolate grandeur; and again I hear the movements of the pack, those small mysterious movements with just the hush sound that comes over the water, and I hear also the swish of the sledge as it came across the snow—I see and hear all these things, and though I cannot explain to you, they will always drag my thoughts back to those good times when these things were before me. Although I may not myself—as perhaps circumstances prove too strong for one—go back to those regions, yet there is always this thought in an explorer's mind, he must hope for those who come after to do better, and so he must always take the intensest interest in their doings. Consequently, I have almost a plea to make for those who are going forth in the same path. Just at present I am sorry to say Antarctic exploration does not meet with much encouragement; but I would like to remind you that a young officer of mine, Lieut. Michael Barne, wishes to go. He has the sympathy of this Society, but little more. However, I hope that in time and by persistence he will not only get more practical sympathy from the Society, but practical sympathy from a larger public. Indeed, this question of the Antarctic I feel is going to be re-opened again, for abroad, in Belgium, an idea of an International Conference has been raised, and that, I hope, will produce good results, though we may not altogether agree with the methods. But I may even have further news to tell you, and news for his Excellency from across the Atlantic; it may be news—I hope it is. At any rate, a correspondent from the other side of the water sends me these cryptic words. He says, "The man with his ear to the ground over here can hear rumours." That means, I am sure, that an American exploring expedition is going forth to the Antarctic Regions, and I have not a doubt that that expedition will attempt to reach beyond that point which we were fortunate enough to reach ourselves, and I have not the least doubt that they will succeed in doing so, and I need not tell you that I heartily wish them success. I can see again—to me the interest of that scene can perhaps be imagined—there in the distance those

mountains which nobody had ever seen before, and which represent the most southerly scene that any mortal man had ever seen. Dim and uncertain as it is, you can imagine how thrillingly interesting any light thrown on that mysterious region must be to me. I heartily wish that the commander of that American expedition may bring information on that subject; and then, sir, I think we shall all look forward to the time when you will present him with a Gold Medal of the Royal Geographical Society, and he will receive it with the same sense of honour with which I have received this medal to-night.

Twelfth Meeting, May 7, 1906.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., F.R.S., President, in the Chair.

ELECTIONS.—*Lieut. E. C. Baker, R.E.; Ralph James Dolby Belham; Captain Chas. Vicars Brocklehurst Boyle (York and Lancaster Regt.); Senhor Dr. Alfredo de Carvalho; Robert Edleston, M.A.; Joshua Goodland; H. R. Hall; Lieut.-Colonel Dugald McTavish Lumsden, C.B.; Edwin S. Oak-Rhind; Fras. Robinson Reeves; Hon. E. J. Stanley; H. F. Ward.*

The paper read was:—

"From the Victoria Nyanza to Kilimanjaro." By Captain G. E. Smith, R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

France—Brittany. **Miltoun.**

Rambles in Brittany. By Francis Miltoun. With many illustrations by Blanche McManus. London: Duckworth & Co., 1905. Size 8 × 5½, pp. xiv. and 376. *Map. Price* 6*s. net. Presented by the Publishers.*

See below, Normandy.

France—Normandy. **Miltoun.**

Rambles in Normandy. By Francis Miltoun. With many illustrations by Blanche

McManus. London: Duckworth & Co., 1905. Size 8 × 5½, pp. xii. and 448. *Maps. Price* 6*s. net. Presented by the Publishers.*

This and the similar work on Brittany contain a considerable amount of practical information which may be useful to the tourist, besides giving the stay-at-home reader a pleasant account of people and places in North-West France.

Holland. ———

Détermination de la Latitude et d'un Azimut aux stations Oirschot, Utrecht, Sambeek, Wolberg, Harikerberg, Sleen, Schoorl, Zierikzee, Terschelling (phare Brandaris), Ameland, Leeuwarden, Urk et Groningue. (Publication de la Commission géodésique néerlandaise.) Delft: J. Waltman, jr., 1904. Size 11½ × 9, pp. lvi. and 286. *Presented by the Commission géodésique néerlandaise.*

Iceland. *G.Z.* **11** (1905): 629–637. **Mogk.**

Island und Seine Bewohner. Von E. Mogk.

Iceland. *Petermanns M., Ergänzungsheft* No. 152 (1905): pp. 162. **Thoroddsen.**

Island. Grundriss der Geographie und Geologie. Von Prof. Dr. T. Thoroddsen. I. *With Maps.* [To be reviewed.]

Italy—Emigration. *Questions Dipl.* **21** (1906): 36–45, 96–110. **Gonnard.**

L'Émigration italienne et les colonies sans drapeau. Par René Gonnard.

Italy—Rome. **Reynolds-Ball.**

Rome. A Practical Guide to Rome and its Environs. By Eustace Reynolds-Ball. London: A. & C. Black, 1906. Size 7 × 4½, pp. viii. and 256. *Plans and Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

Well suited to the tourist who desires to see the best of the antiquities of Rome in a limited time.

Mediterranean—Cyprus. **Richards.**

The Cyprus Civil List 1905. Compiled by T. H. Hatton Richards. Nicosi, 1905. Size 10 × 6½, pp. 152 and lxvi. *Map. Presented by the Chief Secretary to Government, Cyprus.*

Russia. ———

Memoirs of the Military Topographical Department of the General Staff. Vols. **59** and **60**. [In Russian.] St. Petersburg, 1902–3. Size 13½ × 10, pp. (vol. **59**) 100 and 252; (vol. **60**) 138 and 214. *Maps.*

Russia—Cartography. **Shokalsky.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 574–575.

La carte de la Russie d'Europe, en 16 feuilles, à l'échelle de 1:2,000,000. Par Col. J. de Schokalsky.

Scandinavia. *G.Z.* **11** (1905): 657–671. **Kjellén.**

Geopolitische Betrachtungen über Skandinavien. Von R. Kjellén.

Servia. *Ann. G.* **14** (1905): 424–432. **Erdeljanović.**

Les études de géographie humaine en pays serbe. Par J. Erdeljanović.

Spain. *Tour du Monde* **11** (1905): 577–624. **Dieulafoy.**

De Tolède à Grenade. Par M^me^ J. Dieulafoy. *With Illustrations.*

Spain—Numantia. **Schulten.**

Numantia: Eine topographisch-historische Untersuchung. Von A. Schulten. (Abh. K. Ges. W. Göttingen. Phil.-Hist. Klasse. N. F., Bd. viii. Nro. 4.) Berlin: Weidmannsche Buchhandlung, 1905. Size 11 × 9, pp. x. and 112. *Map and Plans. Price* 10*s.*

Switzerland. *Naturw. Wochenschrift* **4** (1905): 817–825. **Brückner.**

Höhengrenzen in der Schweiz. Von Prof. Dr. E. Brückner.

Turkey—Macedonia. **Götz.**

Jahresb. Frankfurter V.G. u. Statistik **68** and **69** (1903–5): 131–135.

Von der Hauptstadt Nordmazedoniens auf den Schardagh. Von Prof. Dr. W. Götz.

Turkey—Macedonia. **Brailsford.**

Macedonia, its Races, and their Future. By H. N. Brailsford. London: Methuen & Co., [1906]. Size 9 × 6, pp. xx. and 340. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.* [To be reviewed.]

United Kingdom—Ireland. **Anderson.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 613–615.

The Flora of Connaught as evidence of the former connection with an Atlantic Continent. By Prof. R. J. Anderson.

United Kingdom—Rainfall. **Marriott.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 340–342.

Rainfall with altitude in England and Wales. By W. Marriott.

United Kingdom—Scotland. *Geol. Mag.* **3** (1906): 22–25. **Jamieson.**

On the Raised Beaches of the Geological Survey of Scotland. By T. F. Jamieson.

United Kingdom—Scotland. **Morris.**

The Forth Valley in Pre-glacial Times. By D. B. Morris. Stirling: J. Hogg & Co., 1905. Size 7½ × 5, pp. 24.

ASIA.

India—Earthquake. *Records Geol. Surv. India* **32** (1905): 258–294. **Middlemiss.**

Preliminary Account of the Kangra Earthquake of April 4, 1905. By C. S Middlemiss. *With Maps.*

India—Survey. **Hobday.**

General Report on the Operations of the Survey of India, 1903–04. Prepared under the direction of Colonel J. R. Hobday. Calcutta, 1905. Size 13½ × 8½, pp. iv., 62, and xlii. *Maps and Illustrations. Presented by the Survey of India.*

Indian Ocean. *B.S.G. Com. Bordeaux* **28** (1905): 307–317, 321–333. **Lorin.**

Les voies d'accès de l'Océan Indien. Par H. Lorin.

Indian Ocean—Seychelles. *Nature* **73** (1906): 294–296. **Gardiner.**

The Percy Sladen Expedition in H.M.S. *Sealark* to the Indian Ocean. The Seychelles Archipelago. By J. Stanley Gardiner. *With Charts and Illustration.*

Noticed in the April number (p. 405).

Japan. **Chamberlain.**

Things Japanese, being notes on various subjects connected with Japan, for the use of travellers and others. By Basil Hall Chamberlain. Fifth Edition, revised. London: John Murray, 1905. Size 9 × 6, pp. vi. and 552. *Map. Price* 10*s.* 6*d. net. Presented by the Publisher.*

This well-known book remains essentially the same in the new edition, though numberless minor alterations have been made.

Korea. **Genthe.**

Korea, Reiseschilderungen von Dr. Siegfried Genthe. Herausgegeben von Dr. Georg Wegener. Zweite Auflage. Berlin: Allgemeiner Verein für Deutsche Literatur, 1905. Size 9 × 6, pp. l. and 344. *Portrait. Price* 6*m. Presented by the Publishers.*

The author (who was murdered in 1903 in Morocco, where he represented the *Cologne Gazette*) was a journalist of an exceptional kind, having had the advantage of a sound university education. His studies of the countries he visited give an excellent insight into their geographical and social conditions, and the collected series of his travels, of which the above forms the first volume, should be well worthy the attention of serious students. Dr. Genthe had for some years been known to geographers as the author of a study on the Persian gulf, produced as a dissertation for the degree of Doctor at Marburg.

Malay Archipelago—Java. **Rouffaer.**

Bijd. Taal-, Land- en Volk. Ned.-Indie **5** (1906): 178–179.

De Chineesche naam Ts'e-ts'un voor Grësik. Door G. P. Rouffaer.

Gresik, on the north coast of Java, was the first place in the island visited by the Portuguese at the beginning of the sixteenth century.

Malay Peninsula. *Petermanns M.* **51** (1905): 249–254, 271–277. **Grubauer.**

Negritos. Ein Besuch bei den Ureinwohnern Innermalakkas. Von A. Grubauer.

Persia. **Gleadowe-Newcomen.**

Report on the British Indian Commercial Mission to South-Eastern Persia during 1904–1905. By A. H. Gleadowe-Newcomen. Calcutta, 1906. Size 13½ × 8½, pp. 2 and 156. *Map. Presented by the Author.*

Persia. *Rev. G.* **55** (1905): 330-339. **Regelsperger.**

La Délégation française en Perse (Mission de Morgan). Par G. Regelsperger. *With Map and Illustrations.*

M. de Morgan's present mission dates from 1897, and has resulted in additions to geographical as well as archæological knowledge.

Persia—Luristan. *Petermanns M.* **51** (1905): 265-271. **Strauss.**

Eine Reise an der Nordgrenze Luristans. Von T. Strauss. *With Map.*

Philippine Islands. **Saleeby.**

Studies in Moro History, Law, and Religion. By Najeeb M. Saleeby. (Dep. of the Interior, Ethnological Survey Publs. vol. **4**, pt. i.) Manila, 1905. Size 10½ × 7½, pp. 108. *Plates. Presented by the Ethnological Survey for the Philippine Islands.*

Philippine Islands. **Pérez.**

Relaciones Agustinianas de las razas del norte de Luzon. Coleccionadas por el Rdo. P. Fray Angel Pérez. (Department of the Interior. Ethnological Survey Publications. Vol. **3**, Spanish Edition.) Manila, 1904. Size 10½ × 7½, pp. 412. *Maps and Illustrations.*

The documents here printed were written, mostly in the eighteenth century, by missionaries working among the native tribes of the north of Luzon. Some will also be issued in English in the publications of the same survey.

Philippines—Ethnology. **Gannett.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 670-675.

The peoples of the Philippines. By Henry Gannett. *With Map.*

Russia—Siberia. *Mem. A. Imp. Sc. St. Pétersbourg* **16**, No. 1 (1904): pp. 126. **Matsokin.**

Mixed races of Trans-Baikalia. Anthropological Study by Dr. P. G. Matsokin. [In Russian.]

Russia—Siberia. ———

Scientific Results of the Expedition sent out by the Imperial Academy of Science for the excavation of the Mammoth found near the River Berezovka in 1901. Vol. 1. [In Russian.] St. Petersburg, 1903. Size 13½ × 10, pp. 156. *Plates. Presented by the Academy of Sciences of St. Petersburg.*

Siam and Malay Peninsula. *J.R. Asiatic S.* (1906): 107-119. **Blagden.**

Siam and the Malay Peninsula. By C. O. Blagden.

Turkey—Palestine. *Palestine Explor. Fund, Quart. Statement* (1906): 50-54. **Watson.**

The Acra. By Sir C. Watson, K.C.M.G. *With Plans and Sections.*

Discusses the position of the ancient fortress of Jerusalem.

Turkey—Palestine—Ancient Map. **Jacoby.**

Das geographische Mosaik von Madaba. Die älteste Karte des Heiligen Landes. Ein Beitrag zu ihrer Erklärung von A. Jacoby. (Studien über Christliche Denkmäler, herausgegeben von J. Ficker. 3 Heft.) Leipzig: T. Weicher, 1905. Size 9½ × 6½, pp. x. and 110. *Facsimile. Price* 4*s.*

Some account of the map was given in vol. **17**, p. 516.

Turkey—Syria. **Euting.**

Jahresb. Frankfurter V.G. u. Statistik **68** and **69** (1903-5): 162-164.

Die Schlossruinen von Meschatta. Von Prof. Dr. J. Euting.

AFRICA.

East Africa—Swahili. **Velten.**

Praktische Suaheli-Grammatik nebst einem Deutsch-Suaheli Wörterverzeichnis. Von Prof. Dr. C. Velten. Zweite Auflage. Berlin: W. Baensch, 1905. Size 7 × 5½, pp. x. and 388. *Price* 4*m. Presented by the Publisher.*

This is, perhaps, the best text-book of Swahili that has yet appeared, and its value is vouched for by the fact that a second edition has been called for within a year from its first appearance.

French Sahara—Economics. **Gautier.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 892-900.

Le valeur commerciale et industrielle du Sahara français. Par E. F. Gautier.

French Sudan. *Rev. Française* **30** (1905): 595-605. **Barré.**

Soudan Français. Le ravitaillement par le bas Niger. Mission Fourneau. Par P. Barré. *With Map.*

Gambia. **Archer.**

The Gambia Colony and Protectorate. An Official Handbook. By Francis Bisset Archer. London: St. Bride's Press, Ltd., [1906]. Size 9½ × 6, pp. xviii. and 364. *Maps, Plans, and Illustrations. Price* 10*s. net. Presented by the Publishers.*

The first ninety-five pages supply a useful history of the Gambia region and its development from the earliest times, the rest of the book forming a handbook of practical and statistical information.

German East Africa. *M. Deutsch. Schutzgeb.* **18** (1905): 359. **Uhlig.**

Erdmagnetische Deklination in Daressalam, mitgeteilt von Prof. Dr. C. Uhlig.

German South-West Africa. *Naturw. Wochenschrift* **5** (1906): 37–40. **Gessert.**

Die Inselberge im Namalande. Von F. Gessert.

German South-West Africa. **Rehbock.**

Deutsch. Kolonialzeitung **23** (1906): 4–5, 12, 23–25.

Die Aufstauung des Grundwassers in den Flussbetten Deutsch-Südwestafrikas. Von T. Rehbock.

German South-West Africa. *Deutsch. Rundschau G.* **28** (1905): 62–66. **Zürn.**

Einiges zur Ethnographie der Hereros. Von R. Zürn. *With Illustrations.*

Libyan Desert. *M.G. Ges. München* **1** (1905): 494–496. **Reichenbach.**

Geographische Beobachtungen in der libyschen Wüste. Von Dr. E. Freiherr Stromer von Reichenbach.

Madagascar. *Tour du Monde* **11** (1905): 541–564. **Du Picq.**

Une peuplade Malgache; Les Tanala de l'Ikongo. Par M. le Lieutenant A. du Picq. *With Map and Illustrations.*

Madagascar—Bibliography. **Grandidier.**

G. Grandidier. Bibliographie de Madagascar. Préface de M. J. Charles-Roux. Première partie. Paris: Comité de Madagascar, 1905. Size 10 × 6¼, pp. viii. and 434.

This part consists of works arranged alphabetically under authors' names, while the second volume is to include anonymous, official, and other publications of a special class. The compilation has evidently been carried out with great care, and the work forms a complete guide to the literature of Madagascar.

Mauritius—Climate. **Claxton.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 352–379.

Climate of Pamplemousses in the Island of Mauritius. By T. F. Claxton.

Natal—Climatology. **Evelyn.**

Rep. Eighth Internat. G. Congress, 1904 (1905): 343–347.

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See the January number, p. 88, and May, pp. 504, 505.

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Bericht über eine Studienreise des Ansiedlungskommissars Dr. Rohrbach nach der Kapkolonie und den angrenzenden britischen Landesteilen.

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Notes on the Geological History of the Victoria Falls. By G. W. Lamplugh, F.R.S.

Mr. Lamplugh has confirmed Mr. Molyneux's views (*Journal*, vol. 25, p. 40).

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From Dawn to Dark on the High Zambesi. By A. Trevor-Battye.

A general picture of the nature of the upper Zambezi without any precise specification of locality.

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Ueber die Wasserverhältnisse im Südlichen Togo. Von Dr. Koert. *Sketch-maps.*

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Geology of the Moose River Gold District, Halifax County, Nova Scotia. By Prof. J. E. Woodman, D.SC. *With Illustrations.*

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Report on the Geology of a portion of Eastern Ontario (*to accompany Map-sheet No.* 119). By R. W. Ells. ('Ann. Rep. Geolog. Surv. Canada,' vol. 14, pt. J.) Ottawa, 1904. Size 10 × 6½, pp. 90. *Map.*

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Recent Mineral Discoveries on Windy Arm, Tagish Lake, Yukon. By R. G. McConnell. Ottawa, 1905. Size 10 × 6½, pp. 12.

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Observacionas geologicas en una ascencion al Citlaltepetl (Pico de Orizaba). Por el Dr. E. Angermann. *With Illustration.*

See *ante*, p. 632.

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Fundación de Mexico-Tenochtitlan. Par Alfredo Chavers.

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The Post-glacial Dispersal of the North American Biota. By C. C. Adams. *With Map.*

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Glacial lakes and Pleistocene Changes in the St. Lawrence Valley. By Prof. A. P. Coleman.

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Lineaments of the Atlantic Border Region. By W. H. Hobbs. *With Map.*

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A Climatological Dictionary for the United States. By Prof. A. J. Henry.

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Geography in the normal schools of the United States. By Prof. Charles Redway Dryer.

United States—Ethnology. **Stevenson.**

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The Zuñi Indians, their Mythology, Esoteric Fraternities, and Ceremonies. By Matilda Coxe Stevenson. *With Illustrations.*

United States—Florida. **MacGonigle.**

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The Glaciers of Mount Hood and Mount Adams. By H. F. Reid. *With Illustrations.*

United States—Hydrology. **Newell and Others.**

Report of Progress of Stream Measurements for the Calendar Year 1904. Prepared under the direction of F. H. Newell. 12 Parts. (U.S. Geol. Surv., Water-Supply and Irrigation Papers, Nos. 124–135.) Washington, 1905. Size 9 × 6. *Maps and Illustrations. Presented by the United States Geological Survey.*

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The Yuma Reclamation Project. By J. B. Lippincott. *With Map.*

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Les limites au nord-ouest de la Louisiane cédée par la France aux États Unis en 1803. Par F. Romanet du Caillaud.

United States—Mississippi. **Morgan.**

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Morgan's journey down the Mississippi in 1767. By Colonel James M. Morgan.

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Glacial Exploration in the Montana Rockies. By Prof. L. W. Chaney.

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Status of the Mesozoic Floras of the United States. Second Paper by Lester F.

Ward, with the Collaboration of William M. Fontaine, Arthur Bibbins, and G. R. Wieland. 2 Parts. Part I.—Text; Part II.—Plates. (Monographs of the United States Geographical Survey, vol. 48.) Washington, 1905. Size 12 × 9½, pp. 616. *Presented by the United States Geological Survey.*

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Geographic Work of the United States Coast and Geodetic Survey. By W. C. Hodgkins and G. R. Putnam.

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What has been accomplished by the United States toward building the Panama Canal. By T. P. Shonts.

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The Glaciers of Poto, Peru. By O. F. Pfordte.

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Estudio de un proyecto para irrigar el valle de Ica. Por C. W. Sutton. *With Maps, Plan, and Diagram.*

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Surveys—Marine. **Littlehales.**
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Marine Hydrographic Surveys of the Coasts of the World. By G. W. Littlehales. *With Map.*

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The Reservoir Lag in Glacier Variations. By H. F. Reid.

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De la Prédominance des Tourbillons en sens inverse des aiguilles d'une montre dans les Cours d'eau de l'Europe Centrale et Occidentale. Par Jean Brunhes.

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Die Thermik der Binnen-Seen und das Klima. Von Prof. Dr. W. Halbfass. *Also separate copy, presented by the Author.*

Meteorology. *B. Musée Océanograph. Monaco*, No. **53** (1905): pp. 6. **Hergesell.**
Sur une exploration de l'atmosphère libre au-dessus de l'océan Atlantique au nord des régions tropicales, en 1905. Par H. Hergesell.

Meteorology. **Marriott.**
Hints to Meteorological Observers. Prepared under the direction of the Council of the Royal Meteorological Society. By W. Marriott. 6th edit. London: E. Stanford, 1906. Size 10 × 6½, pp. 70. *Illustrations. Price* 1*s.* 6*d. Presented by the Author.*

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On the Unsymmetrical Distribution of Rainfall about the path of a Barometric Depression crossing the British Isles. By Dr. H. R. Mill. *With Maps.*

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Die Furchung der Winterschneedecke in den Gebirgstälern. Von Prof. H. Crammer.

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Thermoisodromen. Versuch einer kartographischen Darstellung des jährlichen Ganges der Lufttemperatur. Von Dr. F. v. Kerner. *With Maps.*

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Verhältnis der Temperatur der untersten Luftschicht zu jener der oberen Schichten des Festen und Flüssigen. Von A. Woeikof.
Noticed in the Monthly Record for May (p. 509).

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Ballonaufstiege über dem freien Meere zur Erforschung der Temperatur und Feuchtigkeitsverhältnisse sowie der Luftströmungen bis zu sehr grossen Höhen der Atmosphäre. Von H. Hergesell.

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Rep. Eighth Internat. G. Congress, 1904 (1905): 408–424.
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Origin of the Deep-sea Fauna. By Dr. A. E. Ortmann.

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Die drei Katastrophen-Erdbeben des Jahres 1905. *With Maps and Illustrations.*

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La photographie souterraine au magnésium. Par E. A. Martel. Size 9½ × 6½, pp. 411–424. *Illustrations. Presented by the Author.*

GENERAL.

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An Almanac for the year 1906. Compiled at the offices of the Survey Department, Ministry of Finance. Cairo, 1905. Size 9½ × 6½, pp. 104.

Among other useful tables is one of standard times in the various continents.

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Aerostation associated with the Study of Geography. By E. V. Boulenger.

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Report of the Eighth International Geographic Congress, held in the United States, 1904. Edited by the Committee on Printing. Washington: Government Printing Office, 1905. Size 9½ × 6, pp. 1064. *Maps and Illustrations. Presented by the Congress.*

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Die Forderungen der Geographen an die höhere Schule und die biologische Bewegung. Von H. Fischer.

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Das Wesen und die Methoden der Geographie. Von A. Hettner.

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La Géographie à l'Exposition universelle et internationale de Liége, 1905. Par Dr. F. Kraentzel. (Travaux de Séminaire de Géographie de l'Université de Liége, Fasc. iii.) Liége: D. Cormaux, 1905. Size 10 × 6½, pp. 36. *Illustrations.*

Medical Geography. *B.G.S. Philadelphia* 4 (1906): 29–55. **Ward.**

The Hygiene of the Zones. By Prof. R. De C. Ward.

An outline of the general relations between climate and disease.

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Ergebnisse der Sprachenzählung im Russischen Reiche, 1897.

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The survey upon which these sheets are based was undertaken during the years 1902–04, the necessary funds being supplied partly by the Danish Government and partly by the "Landskasse" of the island itself. The map will be published on two scales, 1 : 50,000 and 1 : 100,000, the latter issue consisting of 115 sheets, while on the former scale each of these sheets is divided into four quarters, making altogether four times the number of the 1 : 100,000 scale. So far all that have been published are coast sheets on the south-east of the island, with special plans of Reykjavik with the immediate neighbourhood, and of the Westmann islands. But if the money is forthcoming, it is hoped that the survey may continue, and other sheets soon be ready for issue.

Judging from the sheets already received, the manner in which the map is to be produced leaves little to be desired. Relief of the land is shown by brown contours at 20-metre intervals, combined with vertical hachuring in the more precipitous parts. On the ice-fields and glaciers the contours are shown in blue. Special care has been taken to indicate the surface features of the land and character of the soil by carefully selected symbols and tints, and the sheets have been well drawn and artistically printed.

Russia. **Topographical Dept., General Staff, St. Petersburg.**

New Special Map of European Russia. Scale 1 : 420,000 or 1 inch to 6·6 stat. miles. Sheets (new editions): 13, 27, 80. St. Petersburg: Topographical Department of the General Staff, 1905.

ASIA.

India. **Deputy Conservator of the Port, Calcutta.**

Chart of the River Hooghly from Calcutta to Saugor, from surveys made by the officers of the River Survey Department under the direction of E. W. Petley, Deputy Conservator of the Port, 1904–1905. Scale 1 : 80,724 or 1 inch to 1·3 stat. mile. Calcutta: Deputy Conservatory of the Port, 1905. *Presented by Lieut. E. W. Petley, C.I.E., R.N., Deputy Conservator of the Port, Calcutta.*

This is a detailed and most complete chart of the Hooghly. In addition to the soundings with which the course of the river is thickly covered, the depths of water are indicated by two tints of blue, whilst sandbanks are shown in a light tint of burnt sienna. All heights are expressed in feet and refer to the level of Kidderpur Dock sill. Soundings are reduced to the levels of the zeros of the local gauges.

Japan. **Japanese Imperial Geological Survey.**

Topographical Map of Japan. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Sheets: Susa; Yamaguchi. Tokyo: Imperial Geological Survey, 1905. *Presented by the Imperial Geological Survey of Japan.*

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet (Gold Coast): 72-O (Provisional issue without hills). London: Topographical Section, General Staff, War Office, 1906. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Transvaal. **Geological Survey of the Transvaal.**

Pretoria and environs, geologically surveyed in November, December, and January, 1904–1905, by H. Kynaston, B.A., F.G.S., Director, A. L. Hall, B.A., F.G.S., and F. A. Steart, F.G.S. Scale 1 : 31,680 or 2 inches to a stat. mile. Johannesburg: Mines Department, Geological Survey of the Transvaal, 1905. *Presented by the Geological Survey of the Transvaal.*

The topography of this sheet is from surveys made in June–July, revised to November, 1900, by No. 1 Survey Section under Major H. M. Jackson, R.E., whilst the geological colouring is from the surveys of November, December, and January, 1904–1905, by Messrs. H. Kynaston, B.A., F.G.S., A. L. Hall, B.A., F.G.S., and F. A. Steart, F.G.S. Although an excellent separate plan of Pretoria and its environs, the sheet really forms part of the large geological survey of the Transvaal which has been commenced.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte topographique de l'Tunisie. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheet: Environs du Kef. *Price* 1.50 *fr. each sheet.* Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: LXII., Maknassy. *Price* 1.20 *fr. each sheet.* Paris: Service Géographique de l'Armée, [1906].

ARCTIC OCEAN.

Barents Sea. **Breitfuss and Smirnow.**

Carte bathymétrique de la mer Barenz par L. Breitfuss et A. Smirnow, 1905. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. St. Petersburg, 1906. *Presented by Dr. L. Breitfuss.*

A chart of the Kara sea, giving depths in figures (metres) and four different tints of blue at 100-metre intervals from 0 to 400 metres, and a darker tint for depths that exceed the latter figure. The valuable work done by the Murman expedition is clearly indicated by the numerous additional soundings given here for the first time, and which greatly increases our knowledge of this part of the north polar basin. Soundings taken by other expeditions are distinguished by their being underlined and by letters placed near them. Attached to the chart is a supplement giving soundings taken by the "Willem Barents" and Weyprecht expedition.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts ii., iii., and iv. London: George Newnes, Limited, [1906]. *Price* 6*d. net each part. Presented by the Publisher.*

The contents of these three parts of this atlas are as follows:—Part ii. Plates: 77, Sugar crop; 78, 79, Sugar-growing countries; 80, Sugar statistics; 109, Cotton supply; 110, 111, Cotton-growing countries; 112, Cotton statistics. Part iii. Plates: 81, Tea crop; 82, 83, Tea-growing countries; 84, Tea statistics; 161, Tobacco supply; 162, 163, Tobacco-growing countries; 164, Tobacco statistics. Part iv. Plates: 89, Wine supply; 90, 91, Wine-growing countries; 92, Wine statistics; 125, Iron production; 126, 127, Iron-mining countries; 128, Iron statistics. Each part contains a continuation of Mr. Taylor's list of commodities of commerce, and upon the back of each of the plates there are interesting diagrams and statistical information referring to the subjects dealt with.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January and February, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3547 m	= 1·0	Scotland, east coast:—Logie head to Nairn. 3*s*.
3538 m	= 1·45	Norway, west coast:—Varholmen to Tiötta. 3*s*.
2680 m	= 1·45	Spain, south-west coast:—Lagos bay and approaches. 2*s*.
3579 m	= 0·1	Cuba, western portion (Preliminary issue). 2*s*.
3580 m	= 0·1	Cuba, eastern portion (Preliminary issue). 3*s*.
3549 m	= 0·7	South America, east coast:—Uruguay river. Parts I. and II. Juncal island to Concepcion del Uruguay. 3*s*.
3550 m	= 1·4	South America, east coast:—Uruguay river. Parts III., IV., and V. Concepcion del Uruguay to Concordia. 3*s*.
3543 m	= 0·14	Malay peninsula:—Approaches to Singapore. 3*s*.
2674 m	= var.	Anchorages on south coast of Celebes. 2*s*.
1527 m	= 1·99	Japan:—Southern approaches to Hirado Kaikyo. 3*s*.
2559 m	= 1·99	New Zealand:—Great Barrier island, ports and anchorages. 2*s*.
1998 m	= 1·99	New Zealand:—Omaha bay to Tiri-Tiri Matangi, including Kawau bay. 3*s*.
3534 m	= 2·99 / 7·26	Harbours and anchorages in the Sandwich islands:—Maalaea bay, Kahului harbour. 2*s*.
2665		France, west coast: Bidassoa river to pointe d'Arcachon. Plan added:—Higuer road.
2804		Chile:—Plans on the west coast of Patagonia. Plan added:—Port Muñoz Gamero.
2248		Mexico, south-west coast:—Anchorages in the Gulf of California. New plan:—San Lorenzo channel.
674 m	= 6·5	Africa, east coast:—Dar es Salaam and adjoining anchorages. New plan:—Dar es Salaam harbour.
100*a* m	= 3·6	Africa, north-east coast:—Rás Galwéni to Rás Hafún. Plan added:—Oloch and Damo anchorages.
750		India, west coast:—Sheet xii. New plan:—Alleppi road.
2196 m	= 3·0	Celebes:—Sketch plan of anchorages in southern part of. New plan:—Labuan Blanda.
957 m	= 3·63 / 7·25	Ports in the Philippine islands. Plans added:—Port Nasipit, Kagayan anchorage.
1472		Plans on the south-west coast of Australia. New plan:—Koombanah bay.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
87 Cape St. Vincent to strait of Gibraltar. Plan on this sheet. Lagos bay	New plan. Lagos bay and approaches	2680
2579 Cuba, western portion.	Preliminary Chart. Cuba, western portion	2579
2580 Cuba, eastern portion.	Preliminary chart. Cuba, eastern portion	2580
2991 River Congo. Kissanga to Camoens point.		—
3161 River Congo. Camoens point to Princes island.		—
9 Arabian sea. Winds and currents during the S.W. monsoon.		—
2674 Anchorages on south coast of Celebes.	New chart. Anchorages on south coast of Celebes	2674
2559 New Zealand. Great Barrier island ports and anchorages.	New chart Great Barrier island ports and anchorages	2559
1998 New Zealand. Kawau island.	New chart. Omaha bay to Tiri-Tiri Matangi, including Kawau bay	1998
1094 Mahurangi harbour and approaches.		

No.		Cancelled by	No.
1377	Harbours and anchorages in Sandwich islands. Plan on this sheet. Kalului harbour.	New chart. Harbours and anchorages in the Sandwich islands. Maalaca bay. Kahului harbour	3534

Erratum.—Chart No. 1982*c* Parana river, sheet 3, is not cancelled by Chart No. 3558, as shown in Bi-monthly List for November and December, 1905.

Charts that have received Important Corrections.

No. 1178, England, west coast:—Trevose head to Bull point. 2496, Scotland, west coast:—Sleat sound. 1185, England, east coast:—River Thames, Sea reach. 2180*a*, Orkney islands, northern portion. 2180*b*, Orkney islands, southern portion. 2910, France, west coast:—Entrance to Gironde river. 79, Spain, north coast:—Ferrol, Coruña and Betanzos inlets. 72, Spain, south-west coast:—Entrance to rivers Tinto and Odiel, Port of Huelva. 1195, Spain, east coast:—Approach to port of Barcelona. 2378, Black sea:—Bug river. 2205, Black sea:—Kertch strait. 1638, Gulf of Mexico:—Breton sound to Derniere island. 546, South America, east coast:—Espiritu Santo bay and Port Victoria. 1337, South America, Magellan strait:—First narrows to Sandy point. 631, Chile:—Smyth channel from south entrance to Fortune bay; 1003, Africa, east coast:—Pungue river, Beira harbour. 6*a*, Gulf of Aden, sheet i.:—Eastern portion, including Sokotra island. 6*b*, Gulf of Aden, sheet ii.:—western portion. 100*b*, Gulf of Aden, Ras Galwéni to Ras Hafun, sheet ii. 2023, Malacca strait, Singapore:—Keppel (New) harbour. 1995, Malacca strait:—Singapore road. 2760, Sumatra, west coast:—Acheh head to Tyingkok bay. 941*b*, Eastern archipelago, Western portion, Sheet ii. 942*a*, Eastern archipelago, Eastern portion, Sheet i. 971, Philippine islands:—Semirara, Ilin, and Ambolon islands, etc. 1269, Cochin China:—Saïgon or Don nai river. 1601, China, north-east coast:—Wusung river. 3225, Japan:—Simonoseki strait to Maruyama zaki; 1674, Australia, east coast:—Brisbane river. 2123, New Guinea, sheet vii.:—Orangerie bay to Bramble haven. 2124, New Guinea, sheet viii.:—Louisiade archipelago, Bramble haven to Rossel island.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for May, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for May, 1906. Washington: Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for May, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bahamas. **Allen and Barbour.**

Sixty photographs of the Bahamas, taken by Dr. G. M. Allen and T. Barbour, Esq., 1904. *Presented by T. Barbour, Esq.*

These photographs were taken during Messrs. Allen and Barbour's zoological expedition to the northern part of the Bahama group, an account of which is given in their "Narrative of a Trip to the Bahamas." The vegetation types are specially interesting.

Great Abaco:—(1 and 6) Narrow path through the mangroves; (2) Water-worn undermined shore; (3) Undermined shore of Æolian limestone; (4) The camera pointed up against the clouds; (5) Dr. G. M. Allen collecting; (7) Our collecting headquarters; (8) West shore of Great Abaco; (9) The Bahama wild duck. Little Abaco:—(10 and 13) A sting-a-ree, *Dasybatis Lastata;* (11 and 15) Limestone cave; (12) *Liocephalus Carinatus;* (14) A cave; (16) Limestone cliffs; (17) Sisal plantation; (18) Herons hiding on nest. New Providence Island:—(19) Street in Bancstown; (20 and 21) Interior vegetation; (22 and 23) Roadside vegetation; (24) Loading live turtles on S.S. *Orizaba*, Nassau; (25) Live young flamingoes for sale as food at

Nassau; (26) Residence of R. S. Johnstone, colonial magistrate, Nassau; (27) Near water-front, Nassau; (28) Royal palms near Nassau; (29) Loading apparatus on schooner *William H. Albury*, Nassau; (30) Giant silk cotton tree, Nassau; (31 and 32) Tree cacti near Nassau; (33) A garden near Nassau; (34) Coconut grove, Nassau; (35–37) Inland vegetation near Nassau; (38) Government House, Nassau; (39) Negro's cabin near Nassau. Grand Bahama:—(40) Mangroves; (41 and 42) Inland vegetation; (43) The outer swamp on north shore of Grand Bahama; (44) Tame flamingo; (45) Mr. Owen Bryant and Mr. T. Barbour. Great Sale Cay:—(46) Mangrove vegetation; (47) Cormorants' nests in mangroves; (48) Shark, *Galeocerdo tigrinum*; (49) Two herons at their nest, John Downer Cay; (50) Shore vegetation, Great Guana Cay; (51) Collecting birds at Moraine Cay; (52) *Carcharias Macubpeinis*, Strangers Cay; (53) Limestone caves, Lubber's Quarters Cay; (54) Shell-tortoise and flamingo; (55) Part of our crew and a tiger shark; (56) Breakfast while under way; (57 and 59) Dredging for zoological specimens among the northern Bahamas; (58) A tame frigate bird; (60) A tame man-o'-war hawk; (61) Mr. Owen Bryant.

Bombay Presidency. **Varley.**

Ten photographs of the Bombay Presidency, taken by F. G. Varley, Esq. *Presented by F. G. Varley, Esq., M.A.*

(1 and 2) Bhusaval, a station on the Great Indian Peninsula Railway; (3) The Railway Institute, Bhusaval; (4 and 5) Scenes in a nullah, dry season; (6) Temple in Ahmednagar; (7) Giving away the rent-rolls to village officers, Ahmednagar; (8) Source of the Godaveri; (9) River front at Nasik; (10) Toranmal, a plateau in the Satpuras.

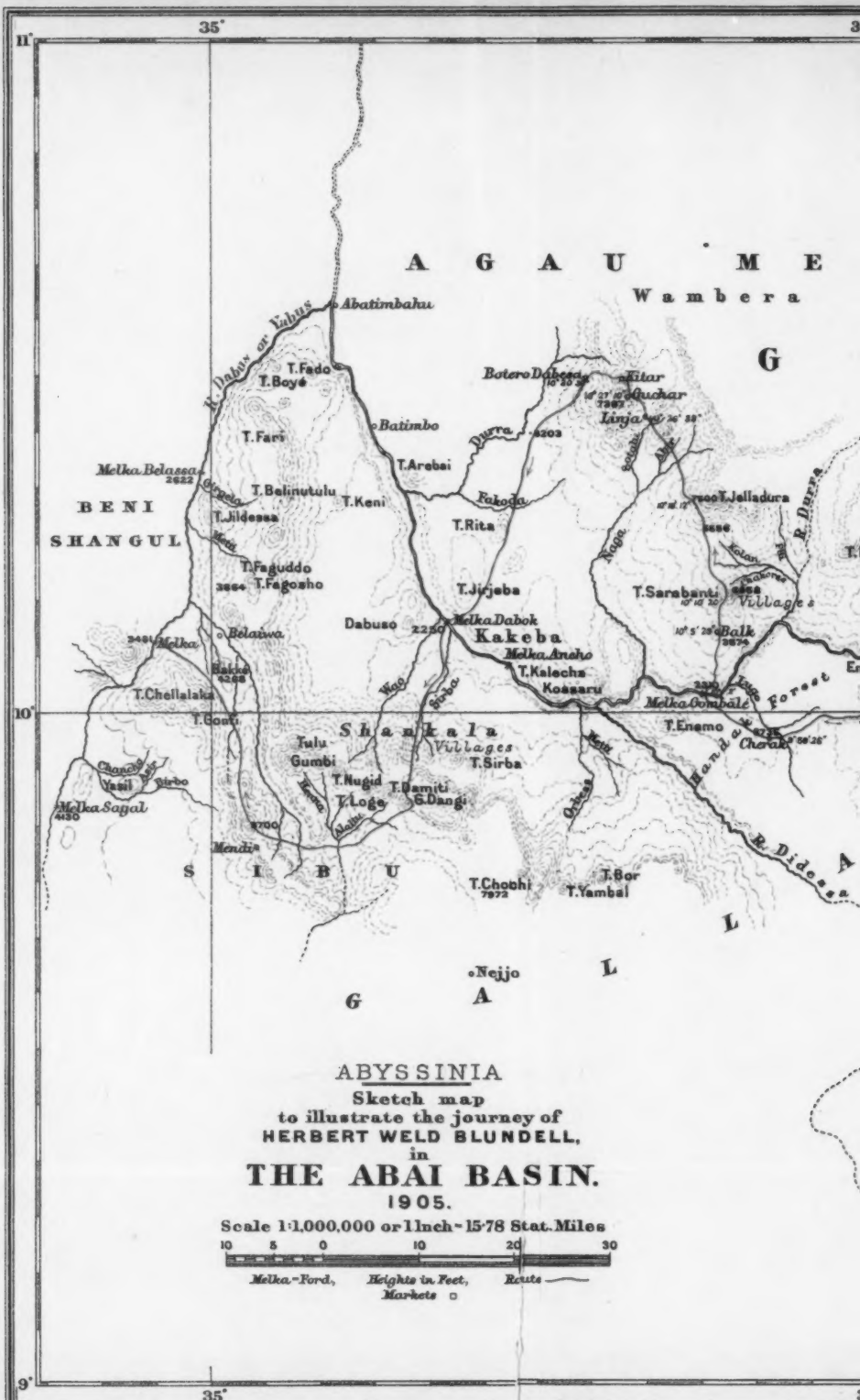
Somaliland. **Swayne.**

Fifty-six photographs of Somaliland, taken by Miss Frances L. Swayne. *Presented by Miss Frances L. Swayne.*

Miss Swayne visited Somaliland in the early part of the present year, and has brought back with her a very good little set of photographs, copies of which she has added to our collection. As will be seen by the titles, the subjects are well selected and typical.

(1) View of Berbera from the harbour; (2) Camp under date palms at Dubar; (3) Fig tree at Bihendula; (4) Gorge at Bihendula; (5) Tree at Lower Sheikh; (6) Some of the Commissioner's camel corps; (7) Two camel sowars; (8) Somali sheep and Persian ram; (9) Somali sheep; (10) Commissioner's camp at Sheikh; (11) Camels driven by girl; (12) Native caravan; (13–15) Camels with European baggage; (16) Euphorbia trees near Commissioner's camp, Sheikh; (17) Glade near militia camp, Sheikh; (18) Camel waiting for the mail-bag, Sheikh; (19) Somali graves, Sheikh; (20) Burden camels feeding on thorn-bushes; (21) Group of servants at Sheikh; (22) Sowars; (23 and 24) Militiamen; (25) Kessaldar Major Musa Farah; (26 and 27) Head camp-man; (28) Head camp-man preparing to take off his saddle; (29) Aakar, Ayal Yunis sub-tribe; (30) Girl, Ayal Yunis sub-tribe; (31) Women and girls picking up sticks; (32) Woman gathering sticks; (33) Woman and baby; (34) Four men; (35) An old man; (36) Abyssinian gardener; (37 and 38) Somalis making cedar walking-sticks; (39) Group of Somalis; (40) Group of Habr Yunis; (41) Inside a "karia;" (42 and 43) Boy minding his own calves; (44) Somali in plaid tobe; (45) Camp within 600 feet of the summit of Waggar, Golis range; (46) Servants' quarters at Waggar; (47) Camp at Dara Ass; (50) View from Dara Ass, looking west; (51) View from Dara Ass, looking south-west; (52) View near Dara Ass camp; (53 and 54) Solitary cedar near Dara Ass camp; (55) View about half a mile from Dara Ass; (56) Specimen of road between Dara Ass and Sheikh.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



ABYSSINIA

Sketch map
to illustrate the journey of
HERBERT WELD BLUNDELL,
in

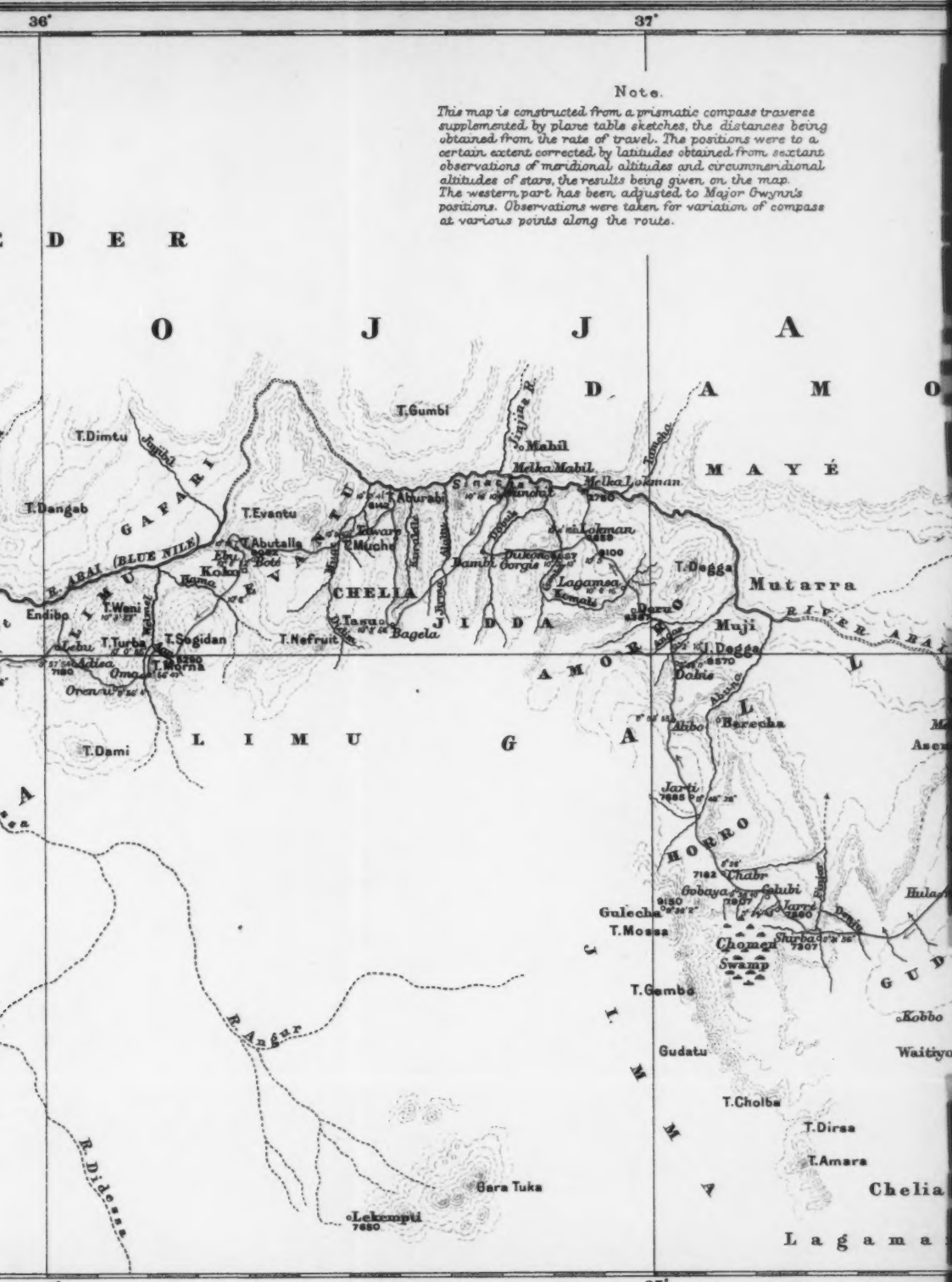
THE ABAI BASIN.

1905.

Scale 1:1,000,000 or 1 inch = 15·78 Stat. Miles

10 5 0 10 20 30

Melka = Ford, Heights in Feet, Markets □ *Route* ——


36°
37°
Note.
This map is constructed from a prismatic compass traverse supplemented by plane table sketches, the distances being obtained from the rate of travel. The positions were to a certain extent corrected by latitudes obtained from sextant observations of meridional altitudes and circummeridional altitudes of stars, the results being given on the map. The western part has been adjusted to Major Gwynn's positions. Observations were taken for variation of compass at various points along the route.
D E R
O J J A
D A M O
M A Y É
T.Gumbi
T.Dimtu
Jogibal
Jajina R.
Mahil
Melka Mahil
Tomcha
Melka Lokman
T.Dangab
G A F A R I
T.Evantu
T.Aburabi
Sinaita
Mindat
T.Abutalla
Tiwarp
T.Muche
Lokman
Dukora
Damti
Gorgis
Lagamsa
Kemata
T.Degga
Mutarra
R. ARAI (BLUE NILE)
Ebi
Bolo
Kokai
Rama
CHELIA
J I D D A
Endibo
T.Weni
T.Lebu
T.Turba
T.Sogidan
T.Nefruit
Tasuo
Bagela
Muji
R. Degga
Dobis
Abuna
Abibo
Berecha
T.Dami
L I M U
G A
Jarti
HORRO
Chabr
Gobaya
Gobubi
Jarra
Gulecha
T.Mossa
Chomen
Swamp
Shirbaba
T.Gemba
Kobbo
Gudatu
Waitiyo
T.Cholba
T.Dirsa
T.Amara
Chelia
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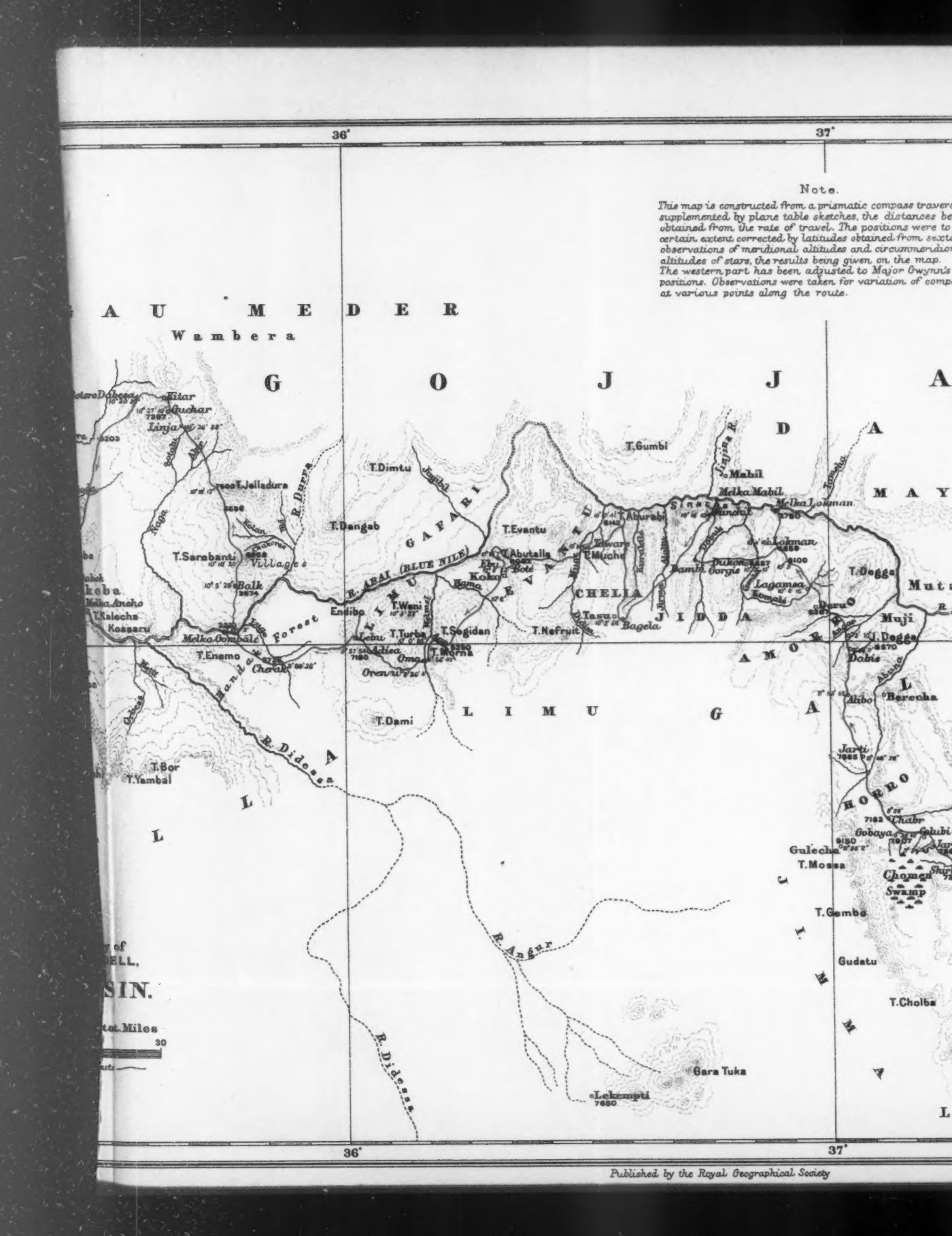
R. Didessa
36°
37°
Published by the Royal Geographical Society


36°
37°
Note.
This map is constructed from a prismatic compass traverse supplemented by plane table sketches, the distances being obtained from the rate of travel. The positions were to a certain extent corrected by latitudes obtained from sextant observations of meridional altitudes and circummeridian altitudes of stars, the results being given on the map. The western part has been adjusted to Major Gwynn's positions. Observations were taken for variation of compass at various points along the route.
A U M E D E R
Wambera
G O J J A
D A
M A Y
Kitar
Guchar
Linja
T.Jelladura
T.Dimtu
T.Gumbi
Mahil
Melka Mabil
Melka Lokman
T.Dangab
T.Evantu
T.Aburabi
T.Sarabanti
Village
Balk
T.Mucha
T.Degga
Lagamsa
Kemels
Dukore
Bambi Gorge
Endibo
T.Wani
T.Turba
T.Sogidan
T.Nefruit
Bagela
Muji
Dabis
Abiko
Bereeha
Jarti
T.Enemo
Cherak
Melka Gombalc
Adisa
Omaa
T.Morna
T.Dami
L I M U G A
T.Bor
T.Yambal
R. Didessa
Chabr
Gobaya
Gulecha
T.Mossa
Chomgi
Swamp
T.Gambo
Gudatu
T.Cholba
Rangur
Gara Tuka
Lekempti
7850
R. ARAI (BLUE NILE)
G A F A R I
L A N D
C H E L L A
J I D D A
A M O R O
H O R R O
L I M M A
Forest
Land of
SIN.
Statute Miles
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Published by the Royal Geographical Society

THE ABAI BASIN.
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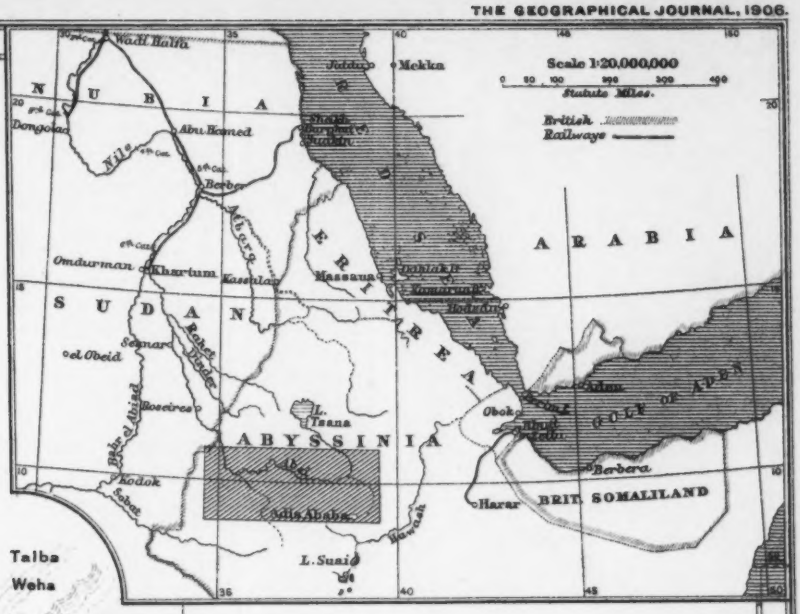


A M

M O T

Y É

Talba
Weha

B A S O

utarra

RIVER ABAI (BLUE NILE)

L A

T. Zamé

Melka Furi
Asendabo
Kao
Alaio
Kuso
Ambabo
T. Abuyé
Bokat
Galakanu
Loya
Ilanu
Adamu
Sabarc
Fuji
Awatu
Kutai
Well wooded
R. Urga
Bité
Gundatwit
Abrana
Well cultivated
Chaffé Robi
Meta
T. Danse
Robi
Meta
T. Robati
T. Amamotu
T. Mulo
Fallé
Hulaguru
Kobbo
Waitiyo
T. Dirsa
T. Amara
Chelia
Lagamara
M E C H A
M U L O
S H O A
G. Silultu
Entotto
ADIS ABABA
British Residency
7250

LIMAT JARSO

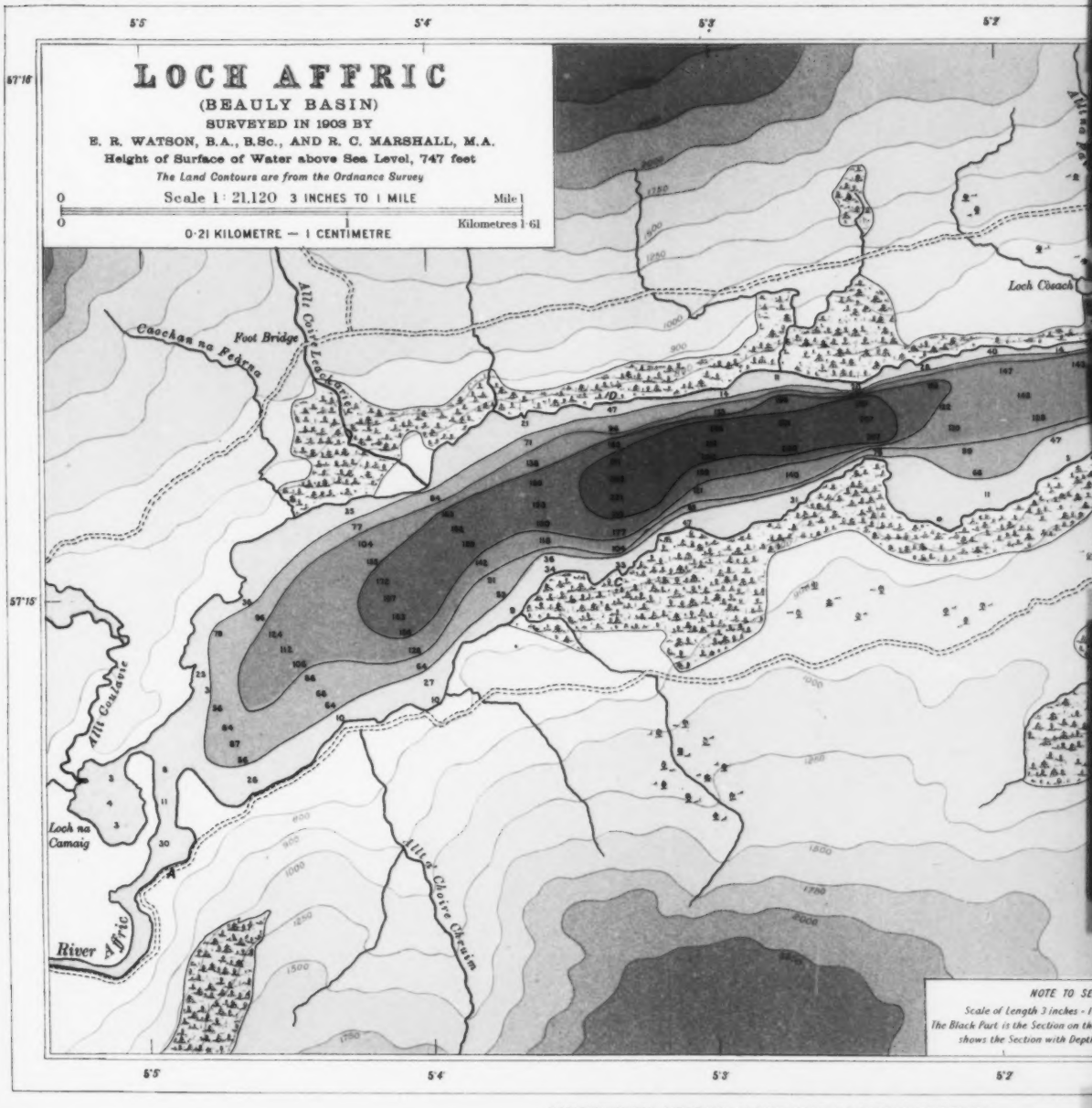
R. Mugr

GUDRE Road

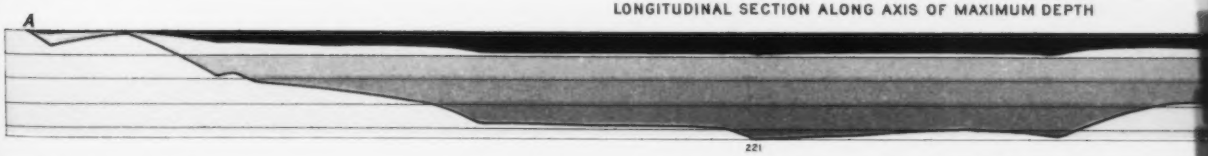
10°
9°
38°

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTL

UNDER THE DIRECTION OF
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



The Edinburgh Geographical Institute

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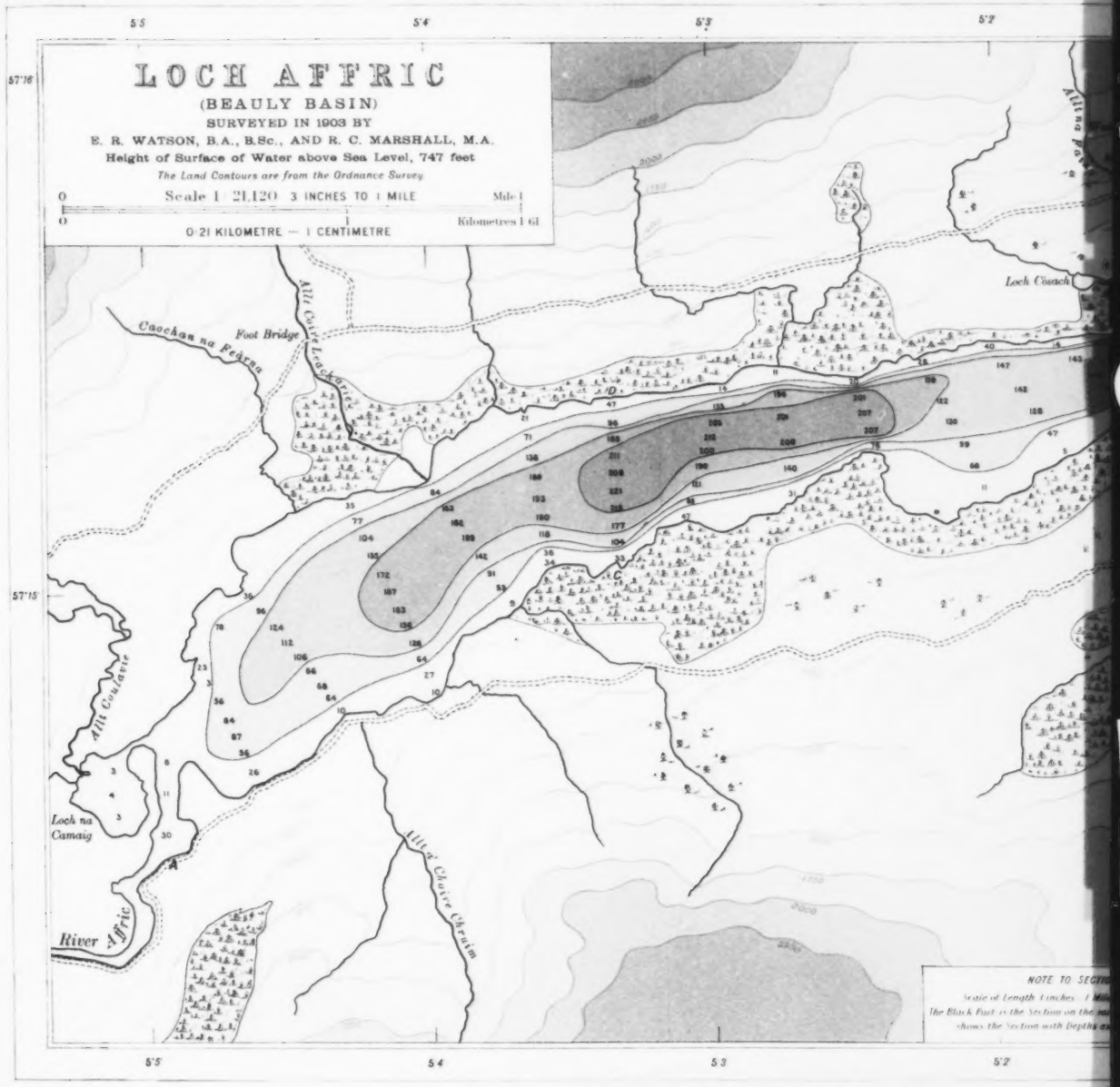
PLATE I



The Edinburgh Geographical Institute

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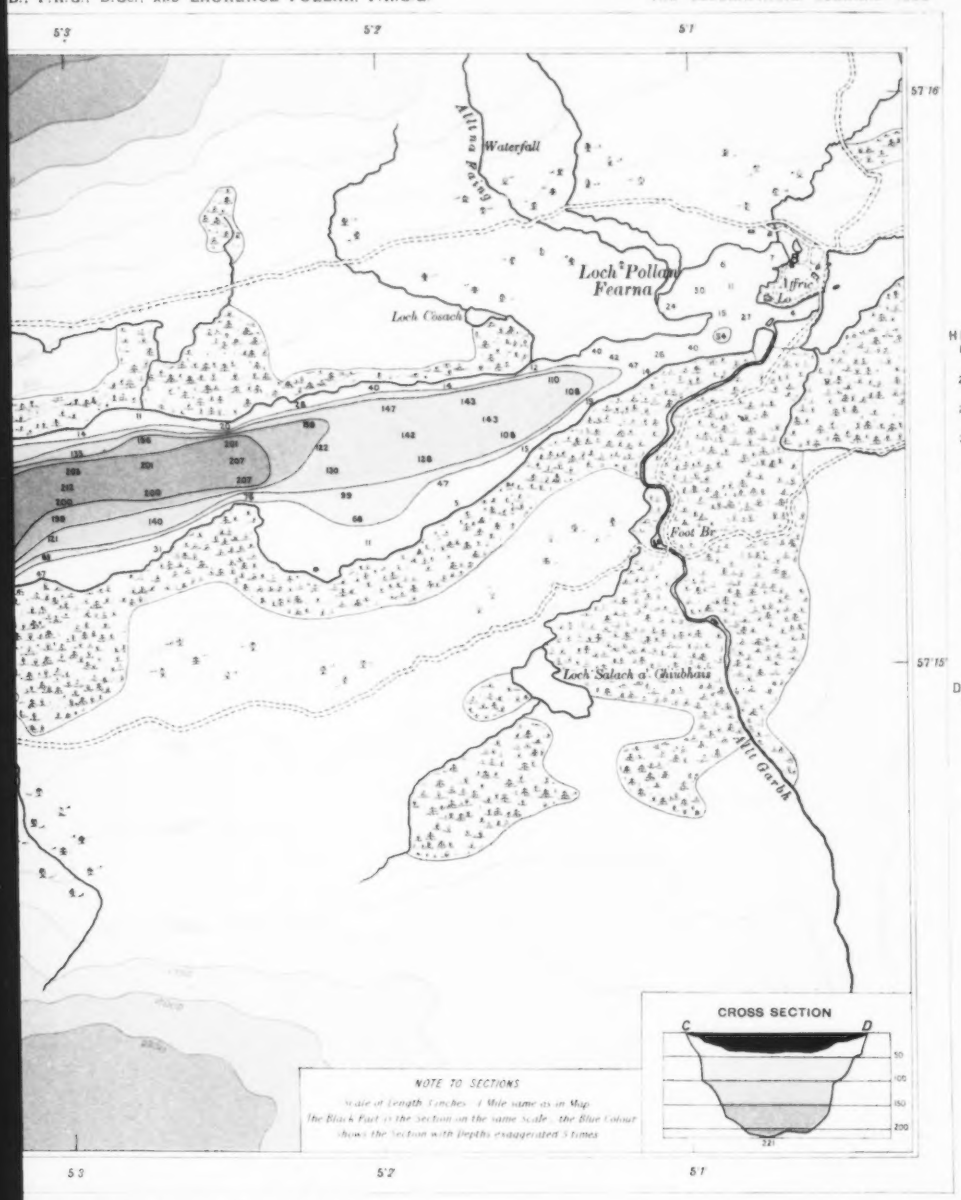
OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



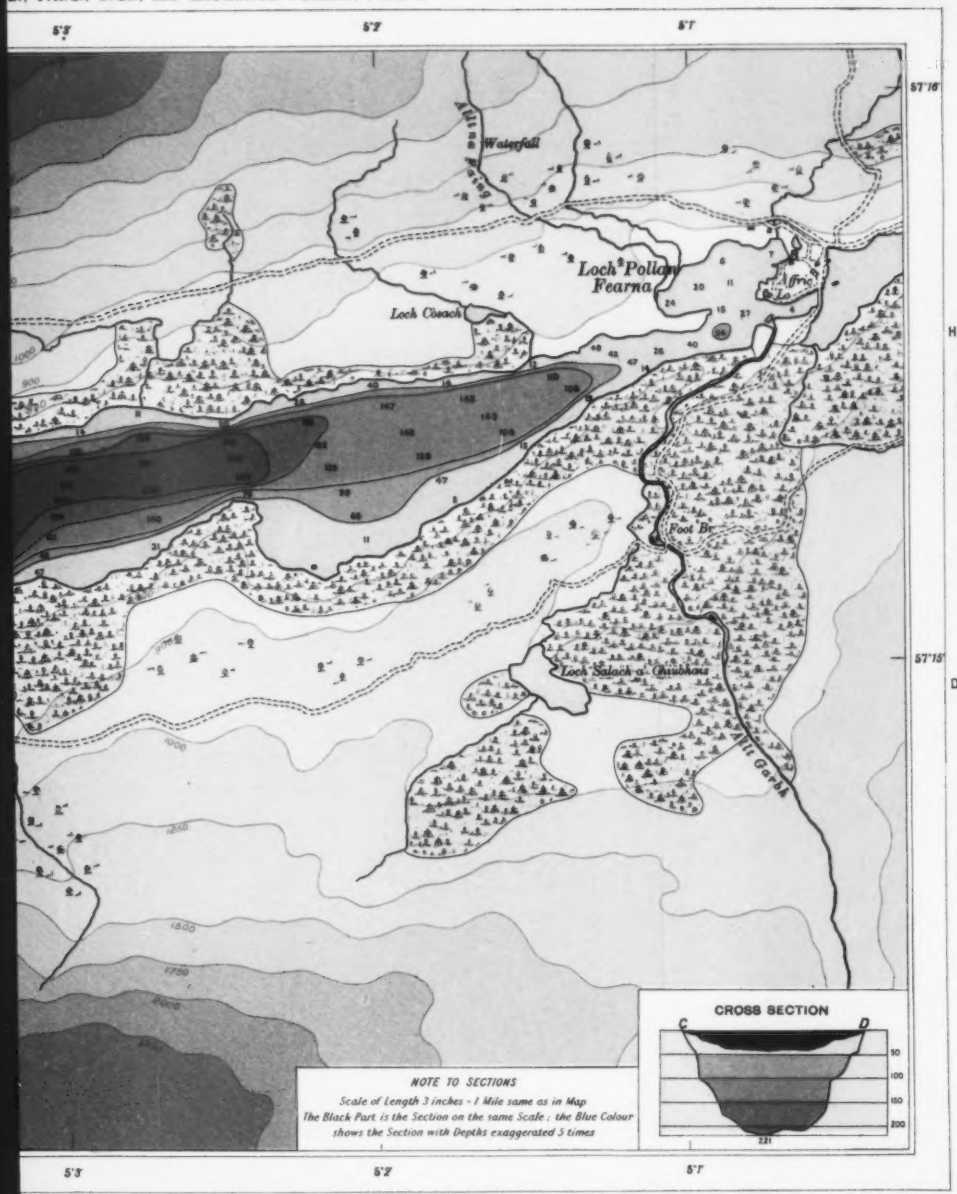
ECTION ALONG AXIS OF MAXIMUM DEPTH

by the Royal Geographical Society

OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



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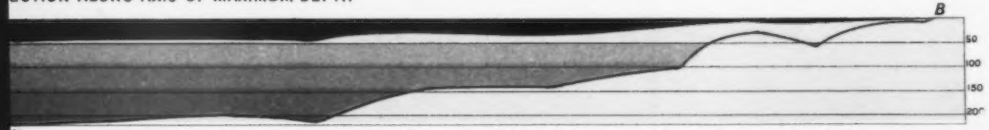


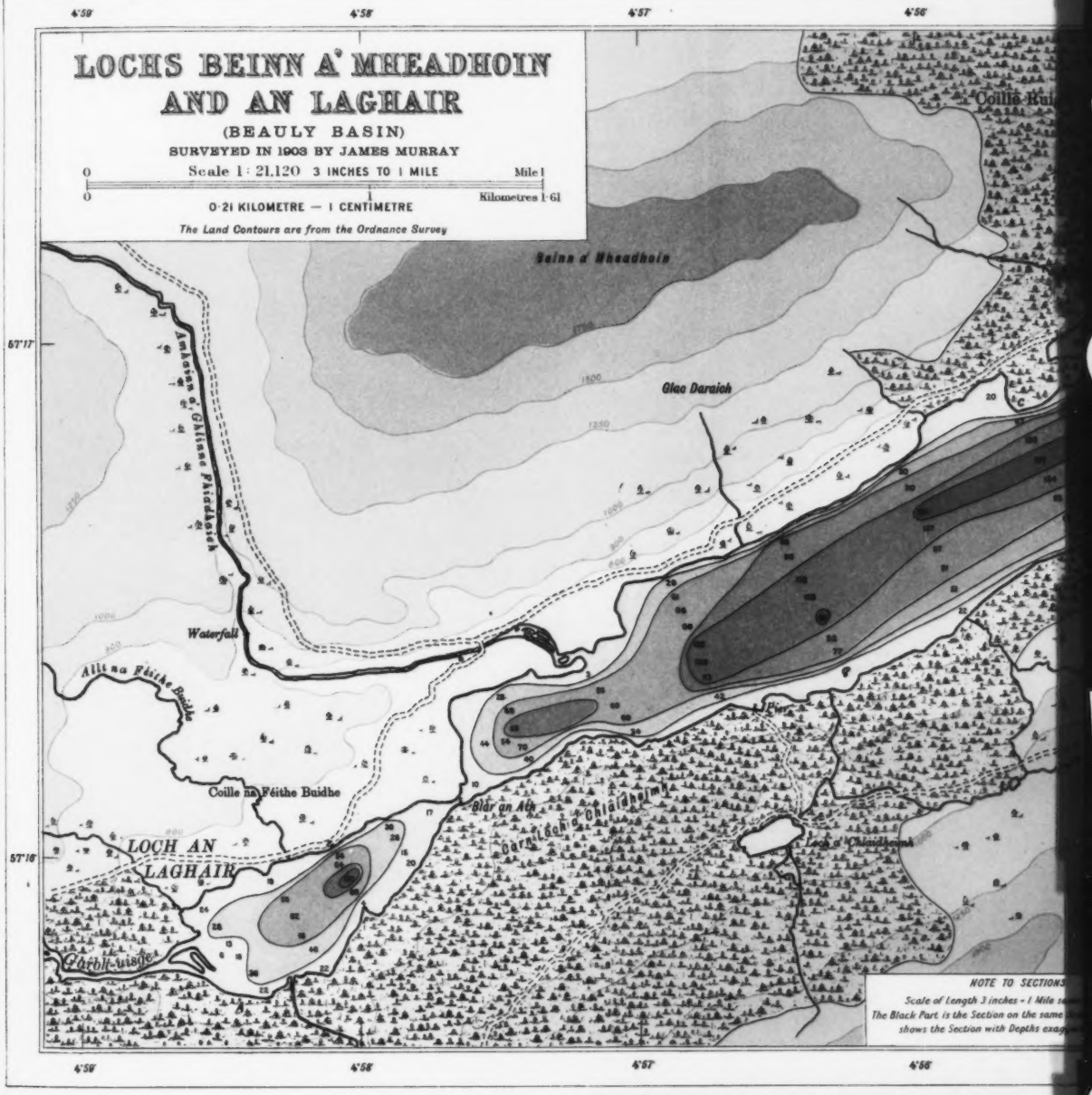
by the Royal Geographical Society

J. G. Bartholomew

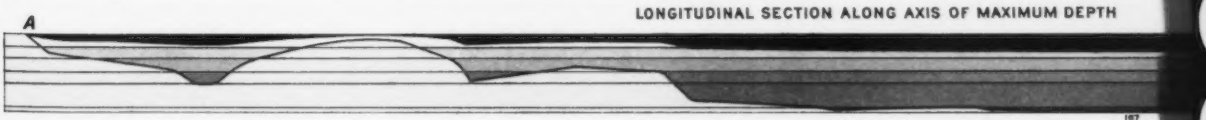
BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF S

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



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THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF
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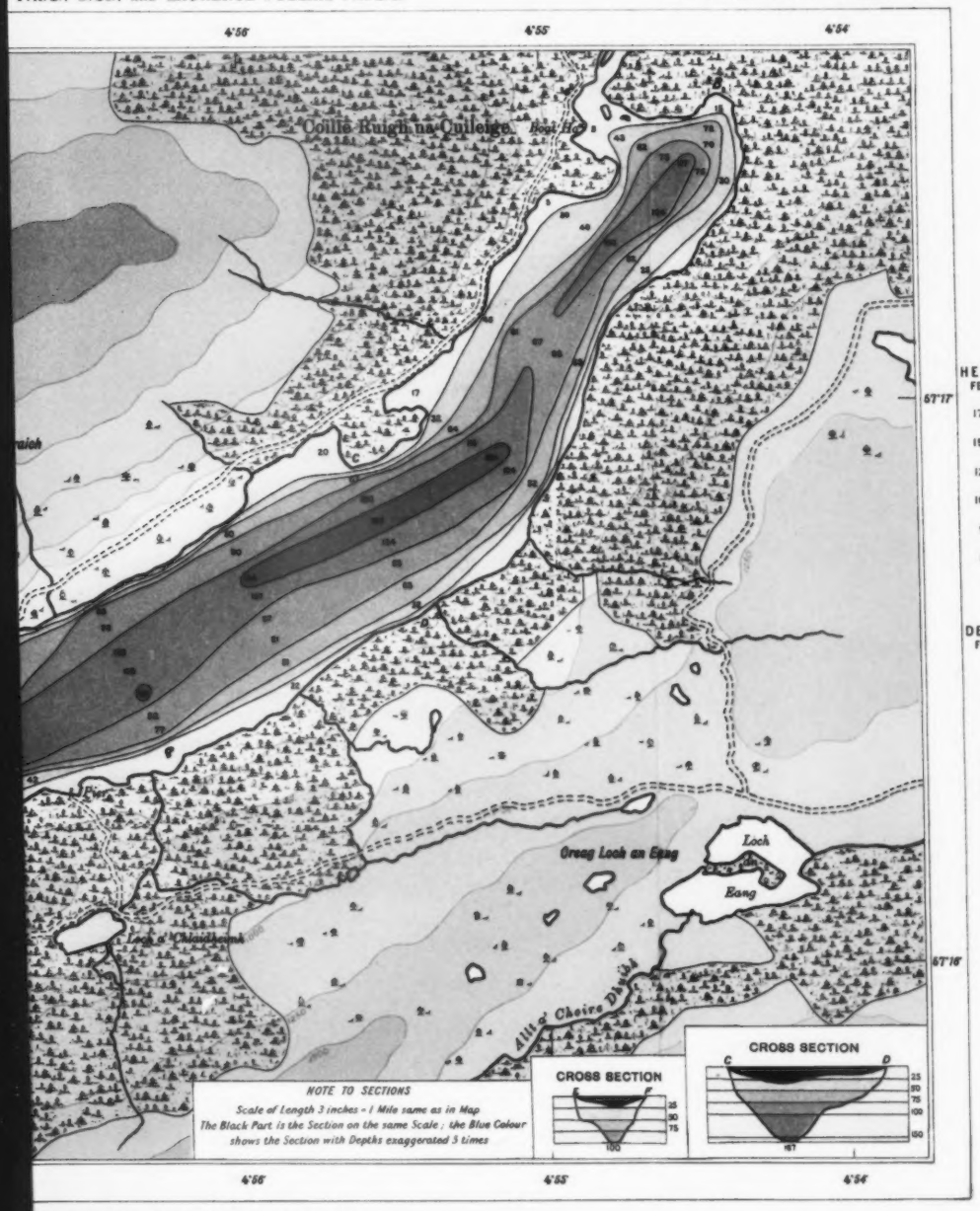

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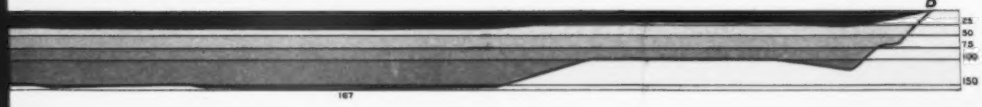

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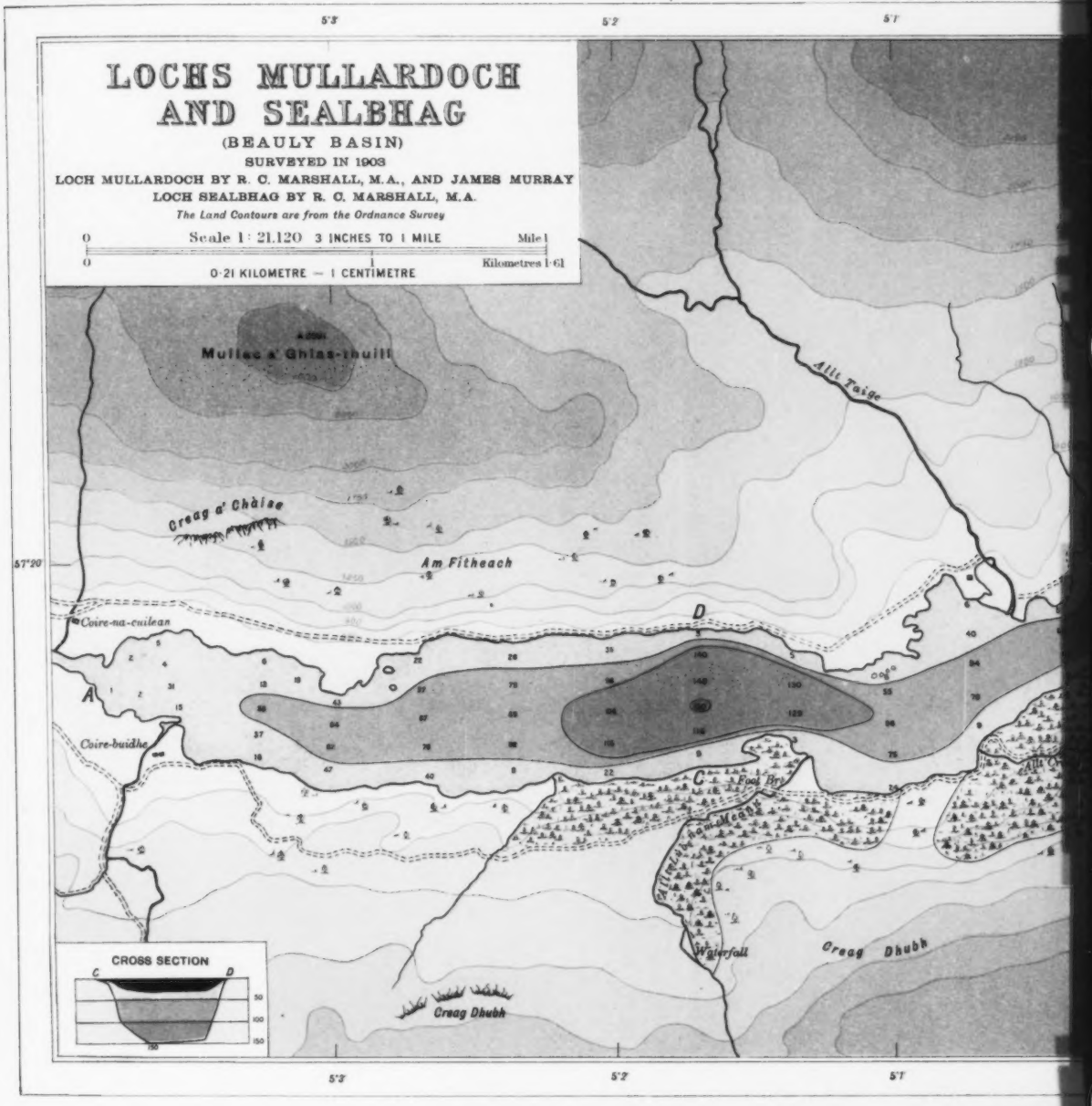
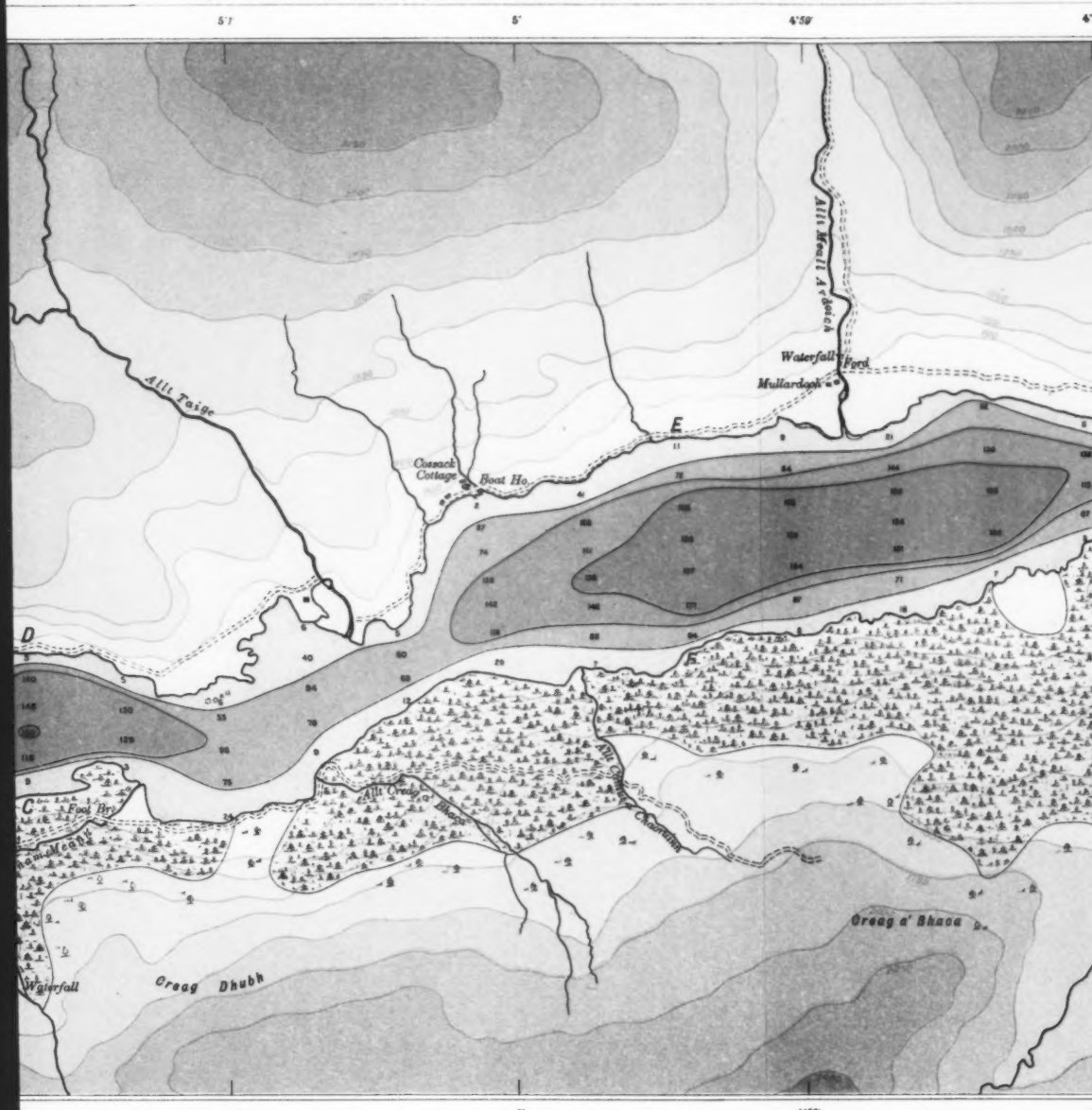

LOCHS MULLARDOCH AND SEALBHAG
(BEAULY BASIN)
SURVEYED IN 1903
LOCH MULLARDOCH BY R. C. MARSHALL, M.A., AND JAMES MURRAY
LOCH SEALBHAG BY R. C. MARSHALL, M.A.
The Land Contours are from the Ordnance Survey
Scale 1: 21,120 3 INCHES TO 1 MILE
Mile 1
Kilometres 1·61
0·21 KILOMETRE = 1 CENTIMETRE
5'3
5'2
5'1
57'20
Mullac a' Ghlas-thuill
Allt Taige
Creag a' Chàise
Am Fitheach
Coire-na-cuilean
Coire-buidhe
Foel Bhr
Meall
Waterfall
Creag Dhubh
Creag Dhubh
A
B
C
D
CROSS SECTION
C
D
50
100
150
LONGITUDINAL
A

THYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SC

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



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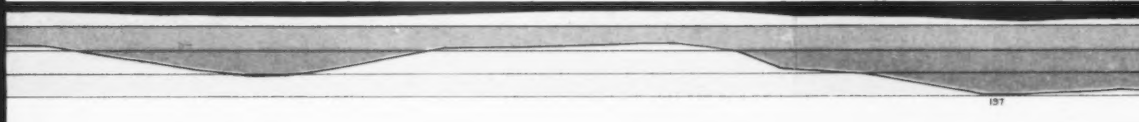

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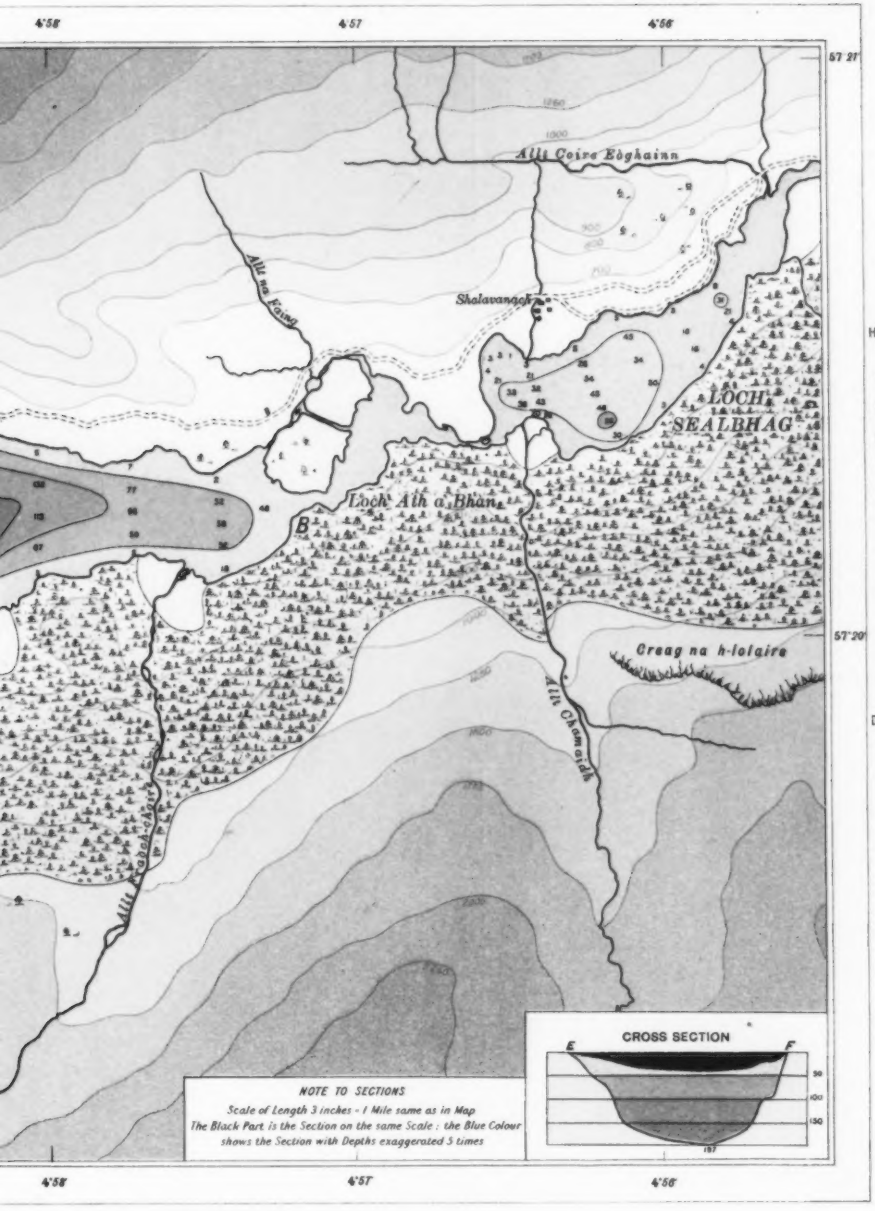
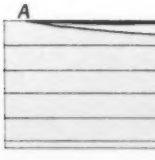


J. G. Bartholomew

PLATE IV



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BATHYMETRICAL SURVEY OF THE FRESH

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND L

OCH MONAR

(BEAULY BASIN)

URVEYED IN 1903 BY JAMES MURRAY

Surface of Water above Sea Level, 663·9 feet

The Land Contours are from the Ordnance Survey

Scale 1 : 21,120 3 INCHES TO 1 MILE Mile 1

Kilometres 1 61

0·21 KILOMETRE — 1 CENTIMETRE

5'7 5'6 5'5 5'4

Maoile Choil'mas
1653

Strathmore Lodge

Coire Aon Ghillespuig

Allt Riabhachain

Aultfearn

Allt Mhalain

Garbh-Uisge

Pait Lodge

Footbridge

LONGITUDINAL SECTION ALONG AXIS

Institute

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UNDER THE DIRECTION OF

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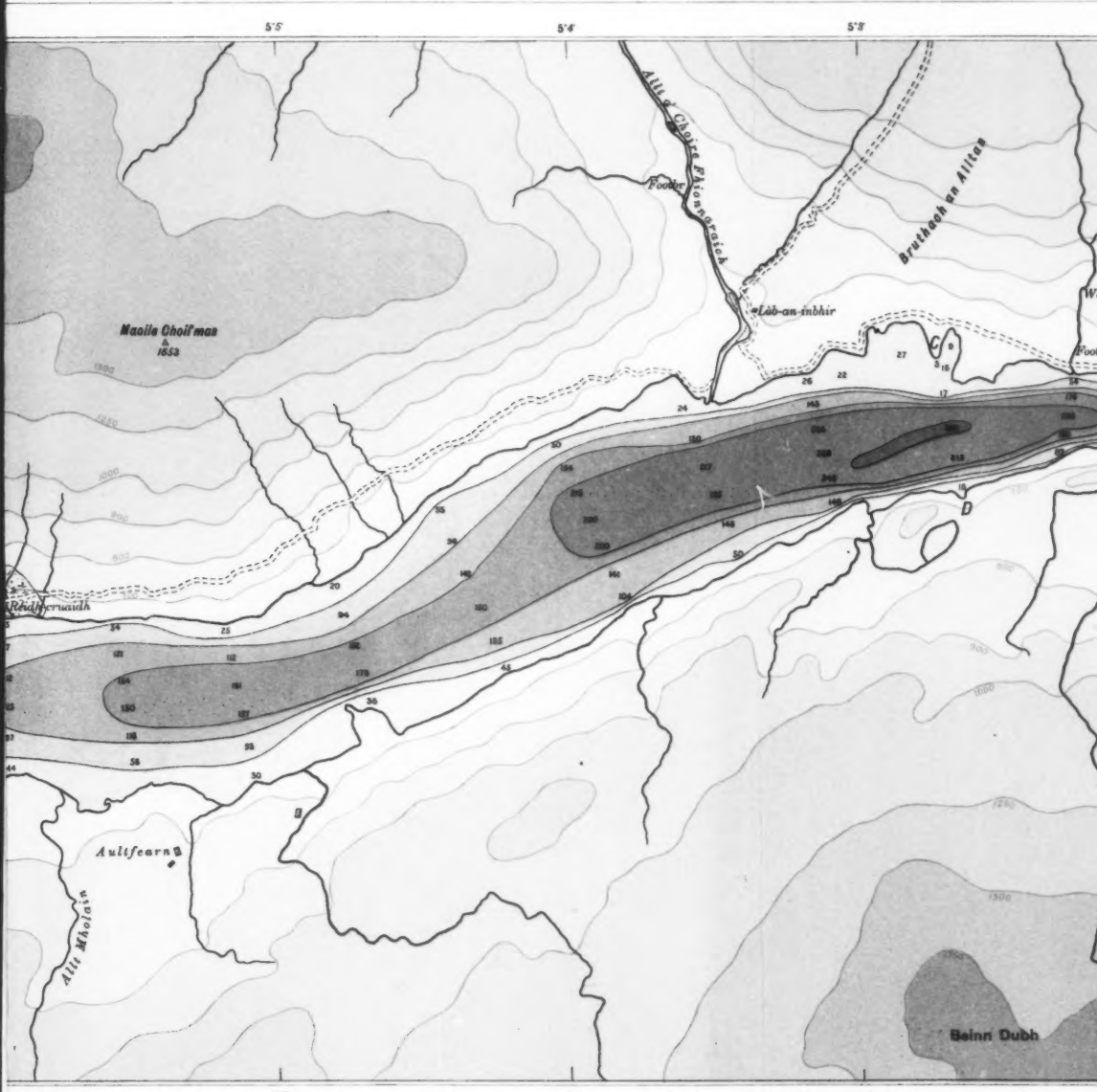
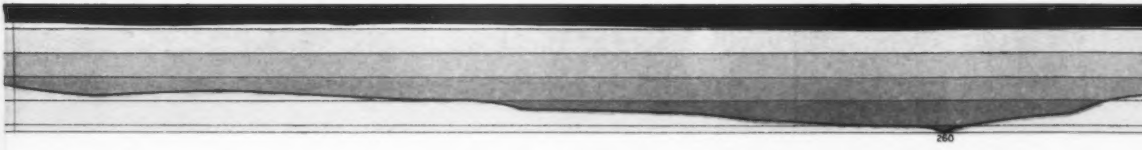


LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



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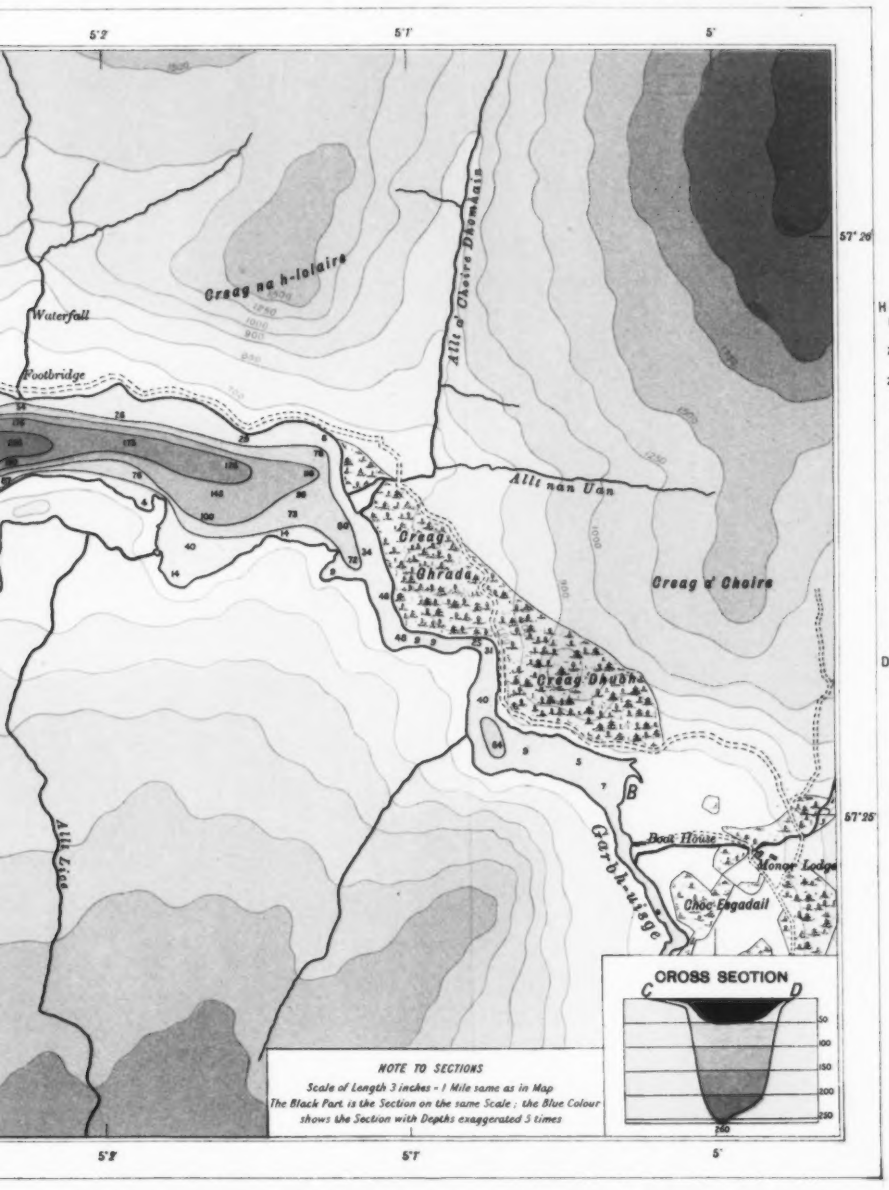

HEIGHTS IN FEET

FEET	METRES
2250	685·8
2000	609·6
1750	533·4
1500	457·2
1250	381·1
1000	304·8
900	274·3
800	243·8
700	213·4

DEPTHS IN FEET

FEET	METRES
50	15·2
100	30·5
150	45·7
200	61
250	76·2

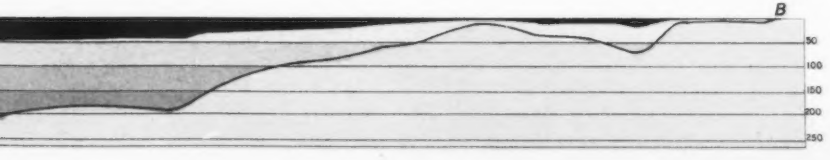

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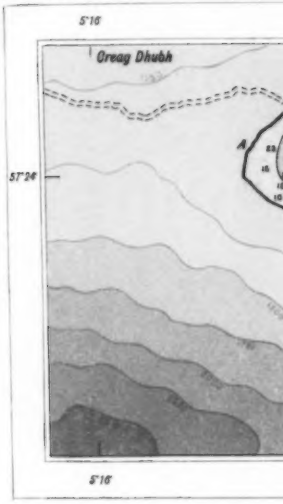
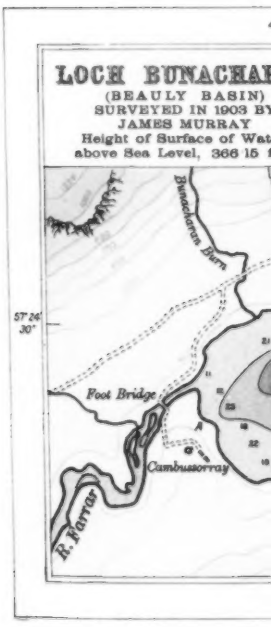
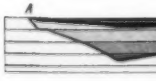
PLATE V


5'16'
Creag Dhubh
57°26'
5'16'

A


LOCH BUNACHAR
(BEAULY BASIN)
SURVEYED IN 1903 BY
JAMES MURRAY
Height of Surface of Wat
above Sea Level, 366·15 f
Bunachoran Burn
57°26'
30"
Foot Bridge
A
Cambussorray
R. Farrar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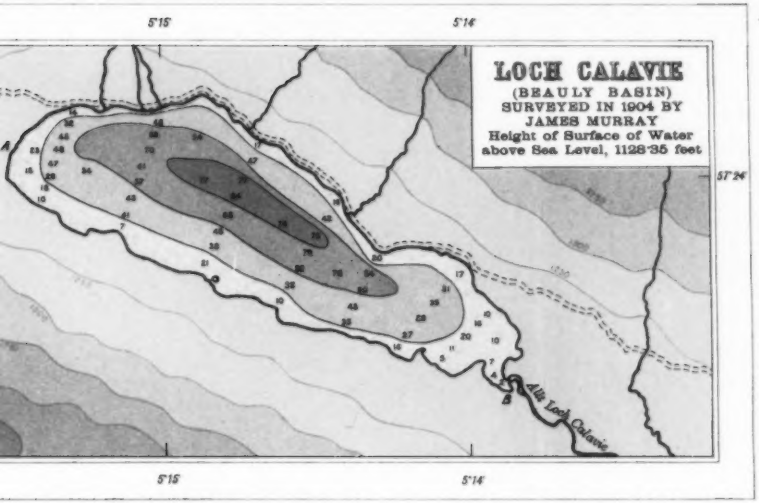
UNDER THE DIRECT

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., A

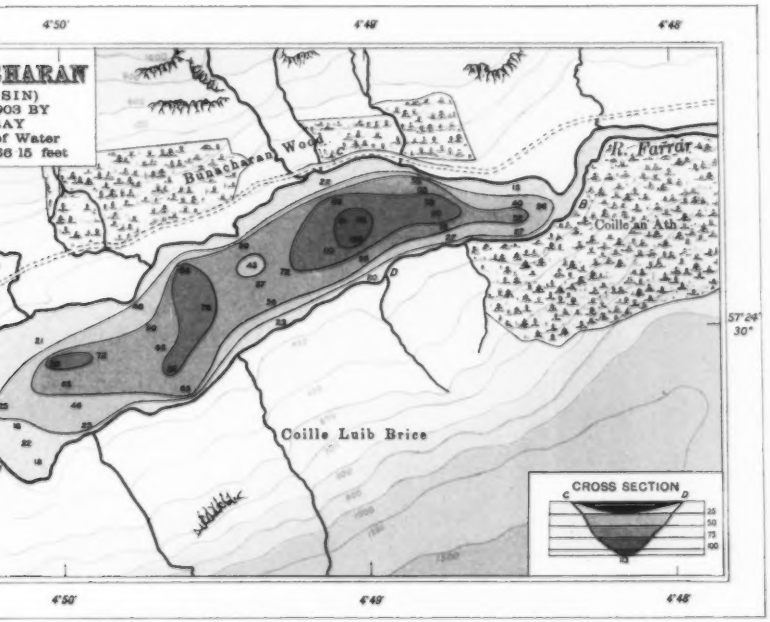


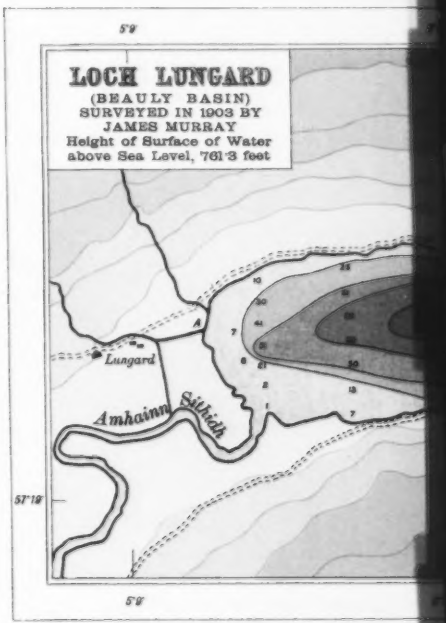
LONGITUDINAL SECTION

Scale 1: 21,120 3 INCHES TO 1 MILE

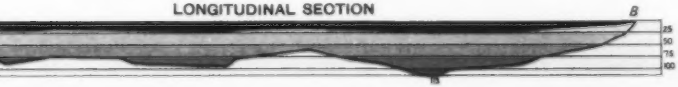
0·21 KILOMETRE — 1 CENTIMETRE

The Land Contours are from the Ordnance Survey





LONGITUDINAL SECTION



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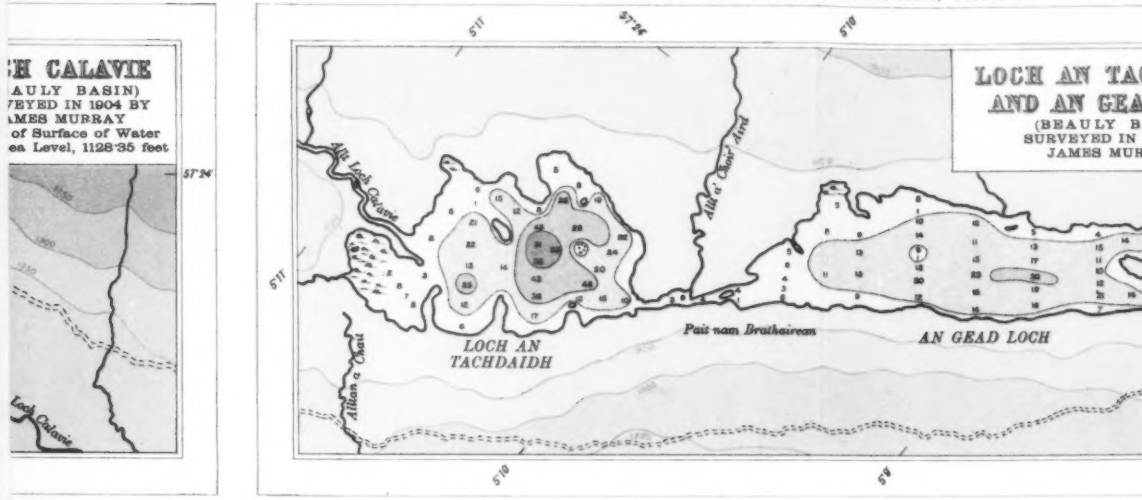


0 Scale 1 : 21,120 3 INCHES TO 1 MILE Mile 1

0 1 Kilometres 1·61

0·21 KILOMETRE — 1 CENTIMETRE

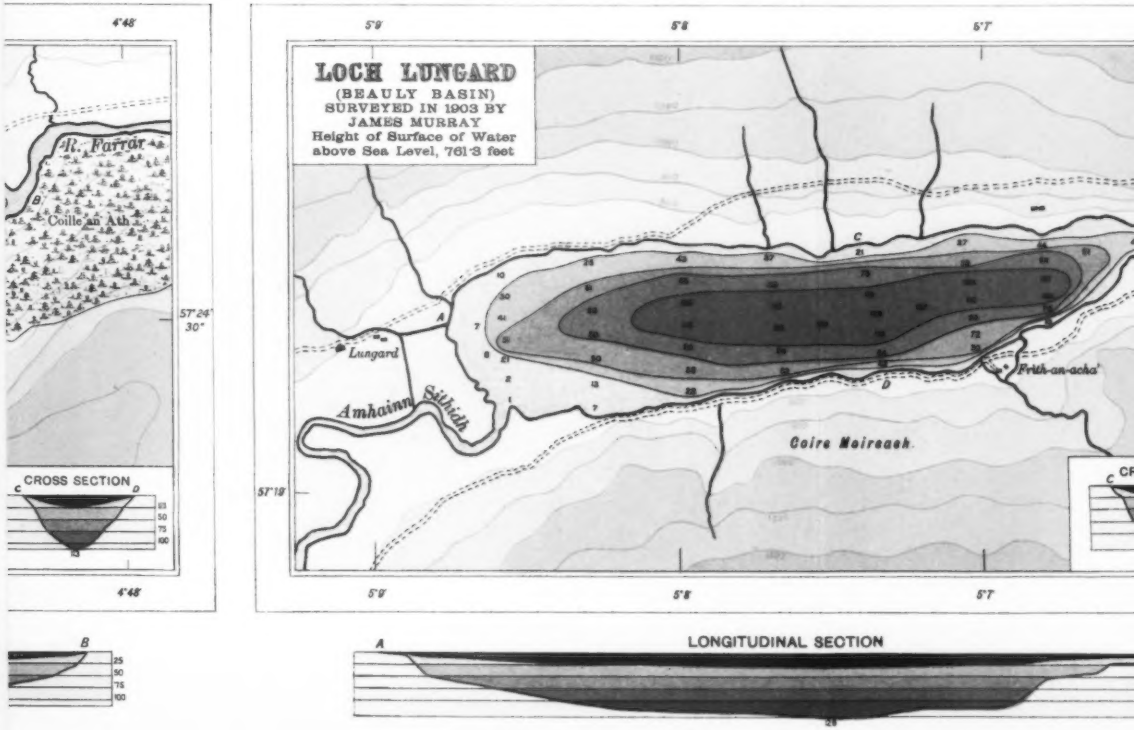
The Land Contours are from the Ordnance Survey

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in h

The Black Part is the Section on the same Scale; the

shows the Section with Depths exaggerated 5 t



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TACHDAIDH
GEAD LOCH
LY BASIN)
ED IN 1904 BY
S MURRAY

5'9

57°24'

...e as in Map
...ale ; the Blue Colour
...rated 5 times

Baa a' Chùl-dhoire

CROSS SECTION

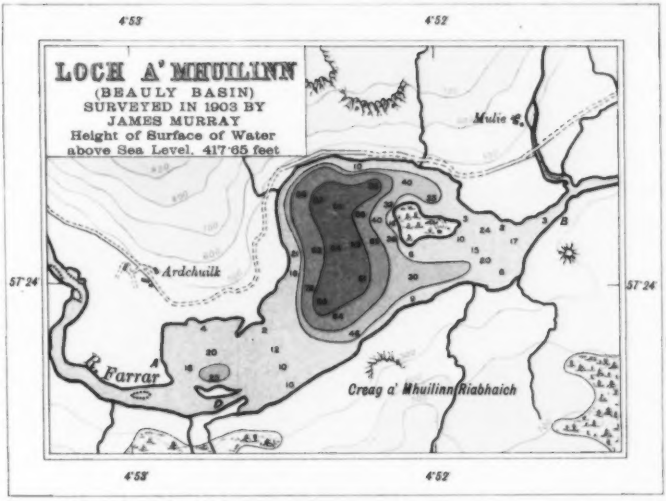
C D

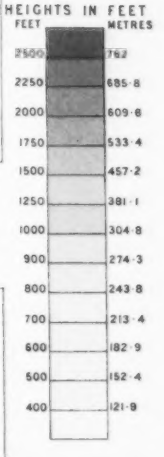
25
50
75
100
125

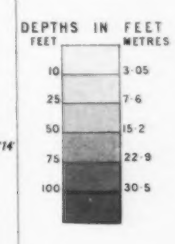
57°19'

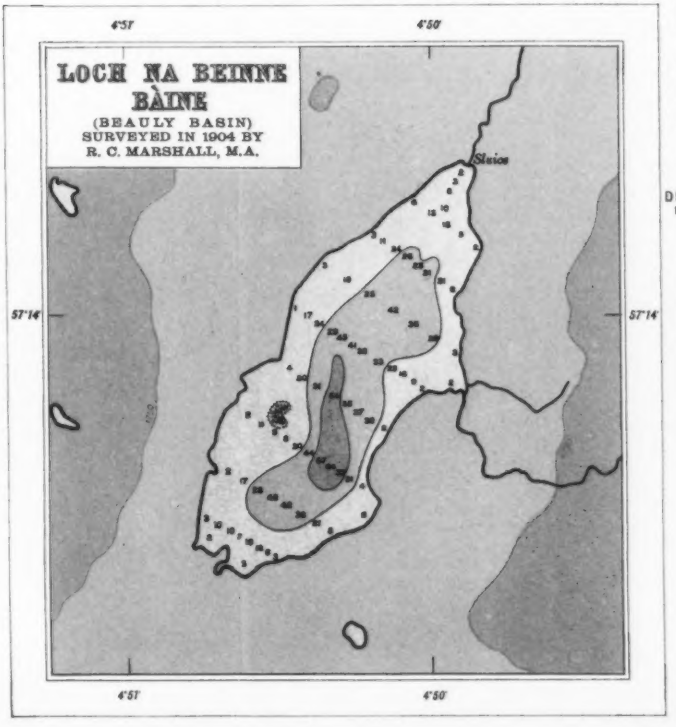
B

25
50
75
100









J. G. Bartholomew

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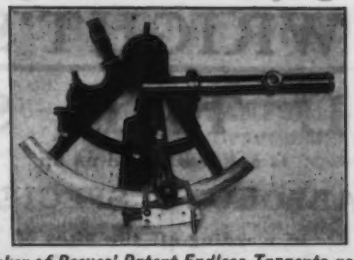

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Research Department.—Friday, June 8, at 5 p.m.—A Plea for the Investigation of Biological (Floral and Faunal) and Anthropological (Racial and Cultural) Distributions in the Pacific. By Prof. A. C. Haddon, F.R.S.

Conversazione.—The Annual Conversazione will be held in the Natural History Museum (by permission of the Trustees) on Friday, June 15. Details will be sent to the Fellows.

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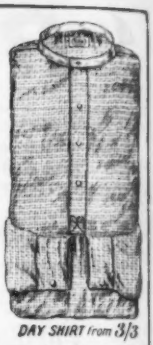

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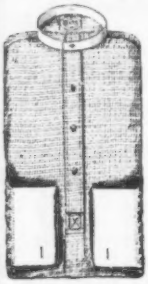

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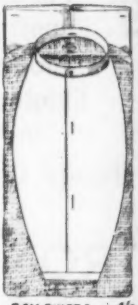

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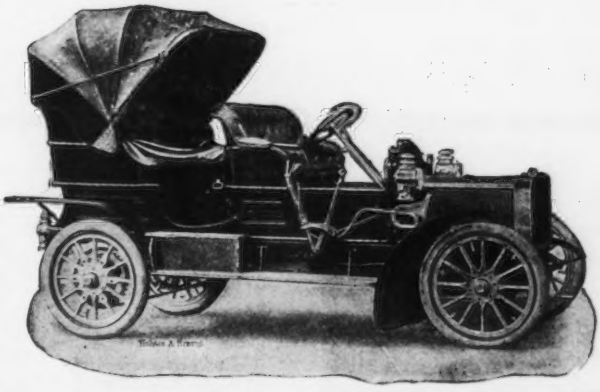

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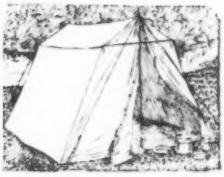

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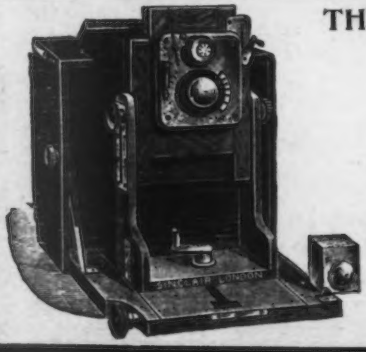

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